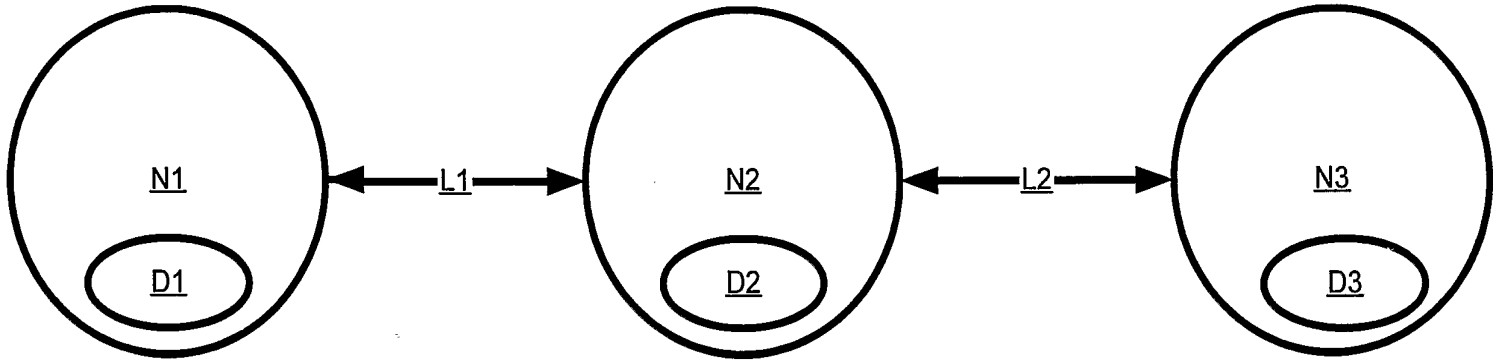



**Table II**
**Initial contents of Database D1**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |

**Table III**
**Initial contents of Database D2**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |

**Table IV**
**Initial contents of Database D3**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |



30

Fig. 1

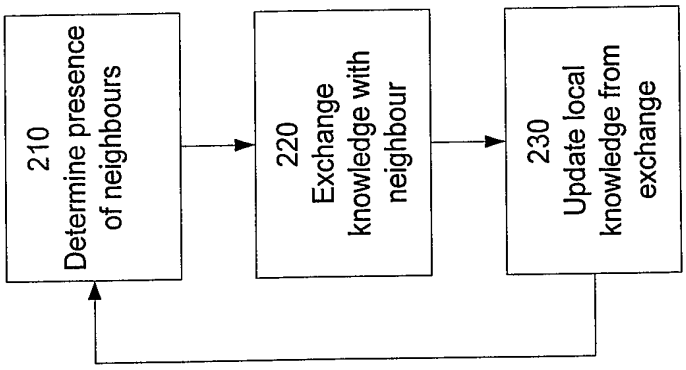

210
Determine presence of neighbours
220
Exchange knowledge with neighbour
230
Update local knowledge from exchange
200

Fig. 2

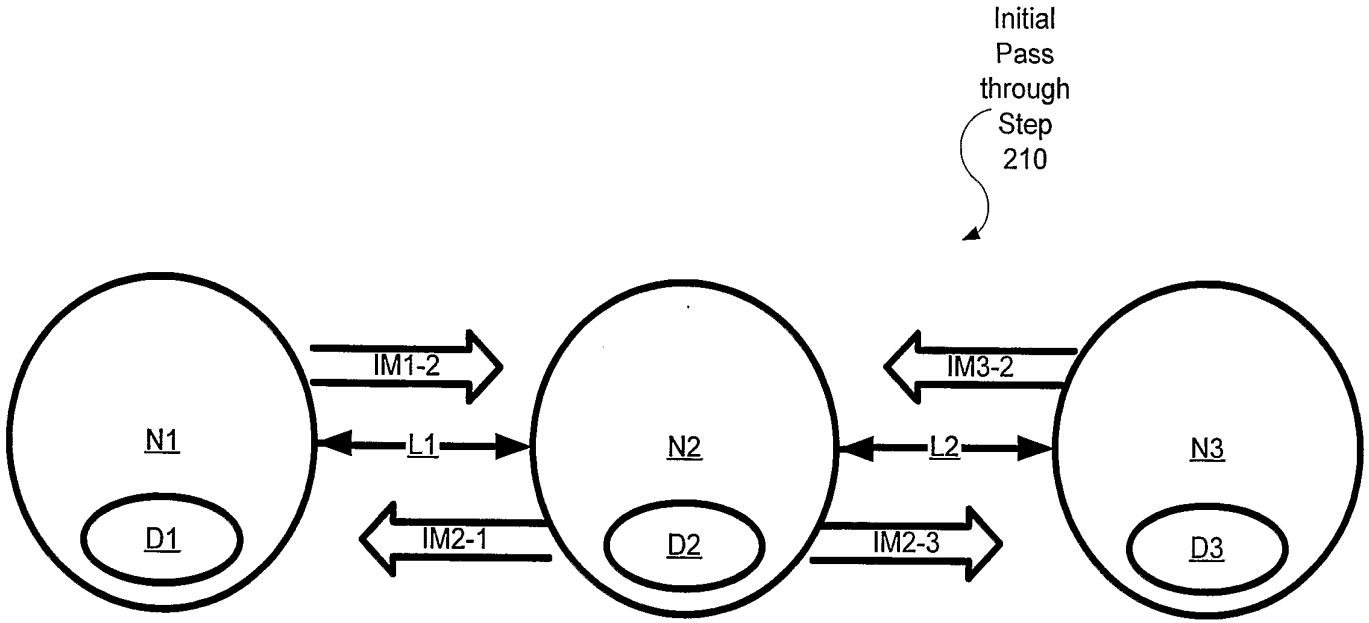



**Table II**
**Initial contents of Database D1**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |

**Table III**
**Initial contents of Database D2**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |

**Table IV**
**Initial contents of Database D3**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |

30

Fig. 3

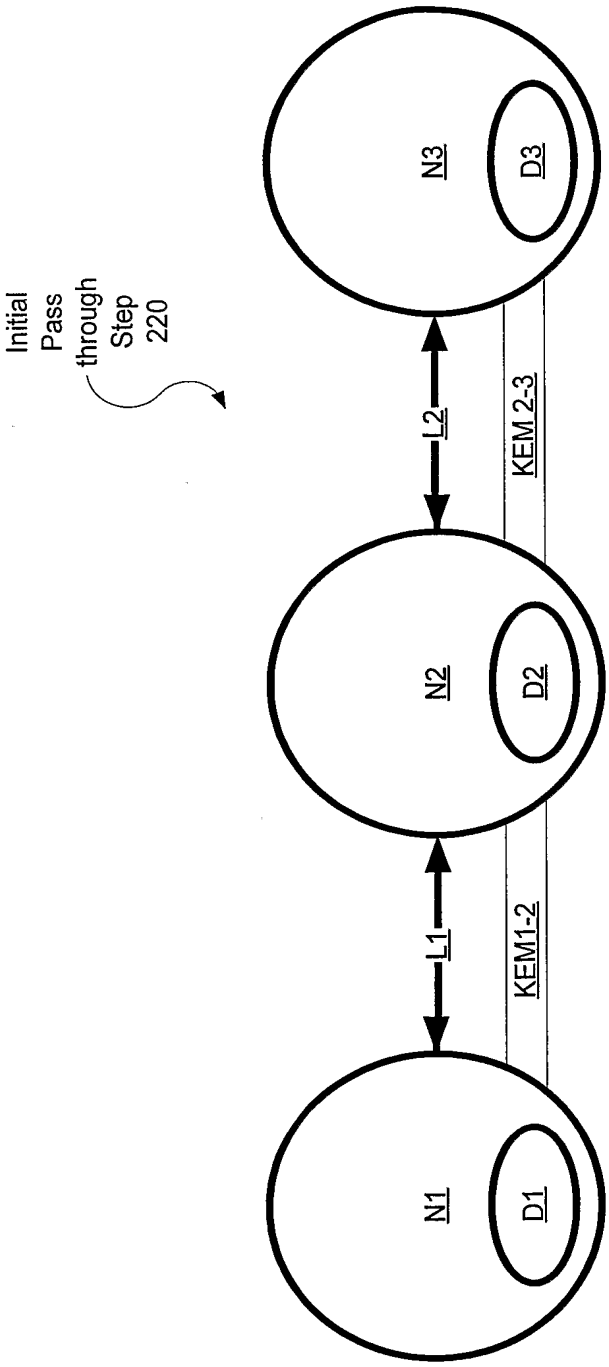



**Table II**
**Initial contents of Database D1**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |

**Table III**
**Initial contents of Database D2**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |

**Table IV**
**Initial contents of Database D3**

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |

30

Fig. 4

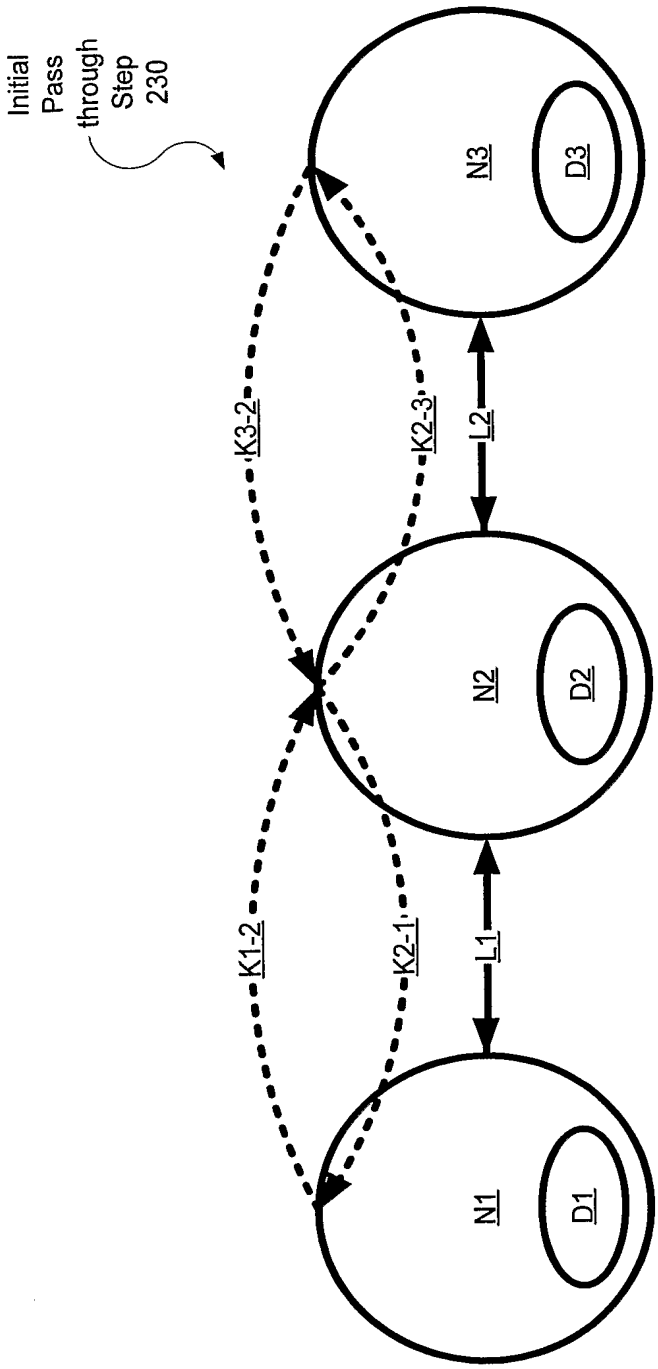



Table V
Database D1

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |
| 1 | N2 | N2 |

Table VI
Database D2

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |
| 1 | N1 | N1 |
| 2 | N3 | N3 |

Table VII
Contents of Database D3

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |
| 1 | N2 | N2 |

Fig. 5

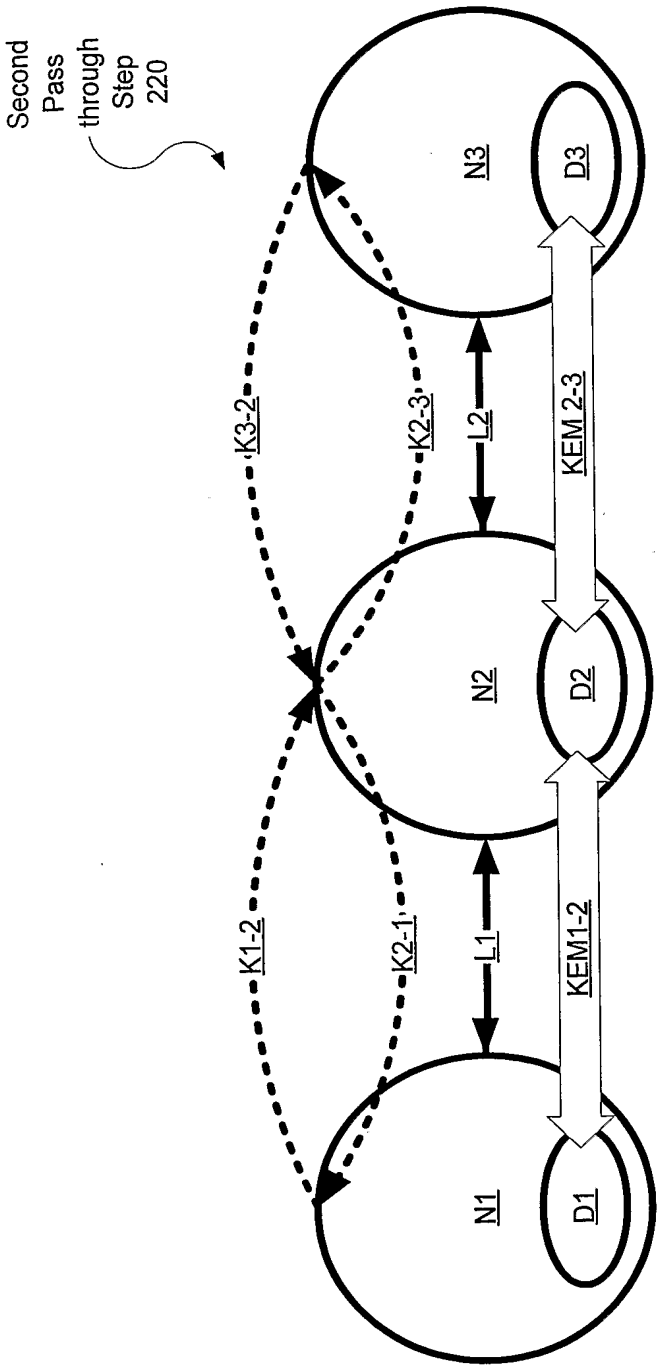



Table VIII
Database D1

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |
| 1 | N2 | N2 |
| 2 | N3 | N2 |

Table IX
Database D2

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |
| 1 | N1 | N1 |
| 2 | N3 | N3 |

Table X
Contents of Database D3

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |
| 1 | N2 | N2 |
| 2 | N1 | N2 |

Fig. 6

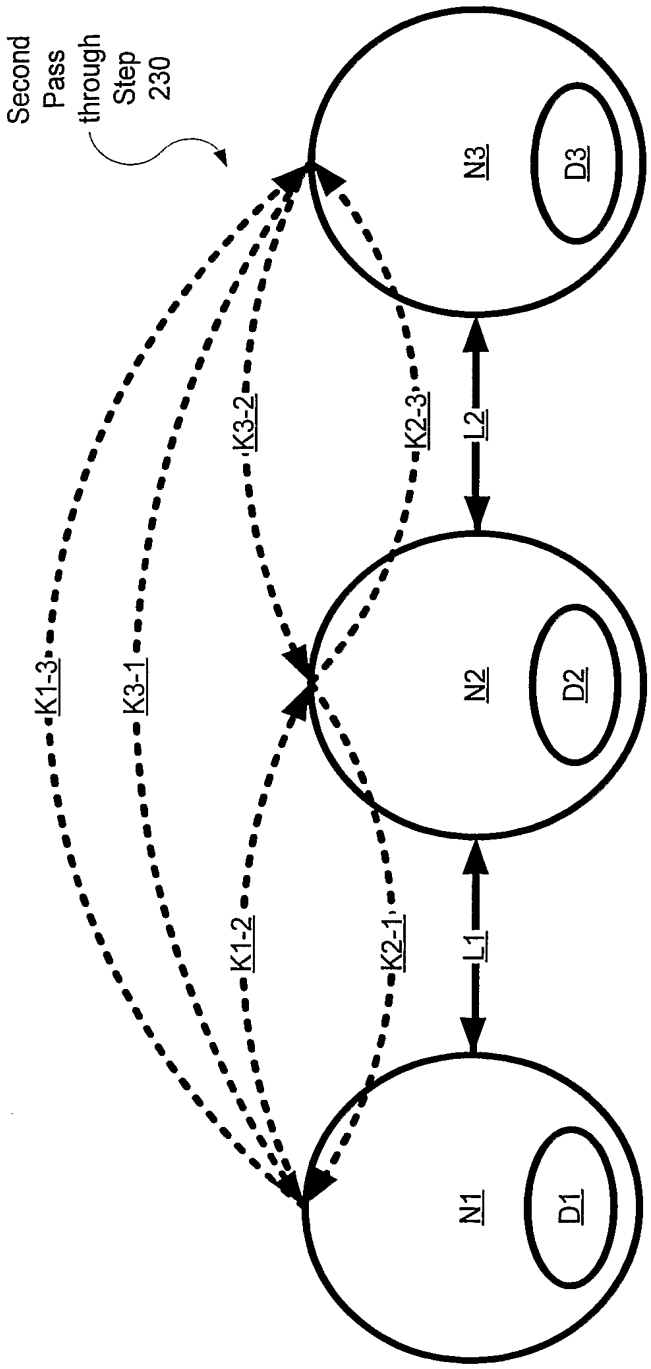



Table VIII
Database D1

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |
| 1 | N2 | N2 |
| 2 | N3 | N2 |

Table IX
Database D2

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |
| 1 | N1 | N1 |
| 2 | N3 | N3 |

Table X
Contents of Database D3

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |
| 1 | N2 | N2 |
| 2 | N1 | N2 |

30

Fig. 7

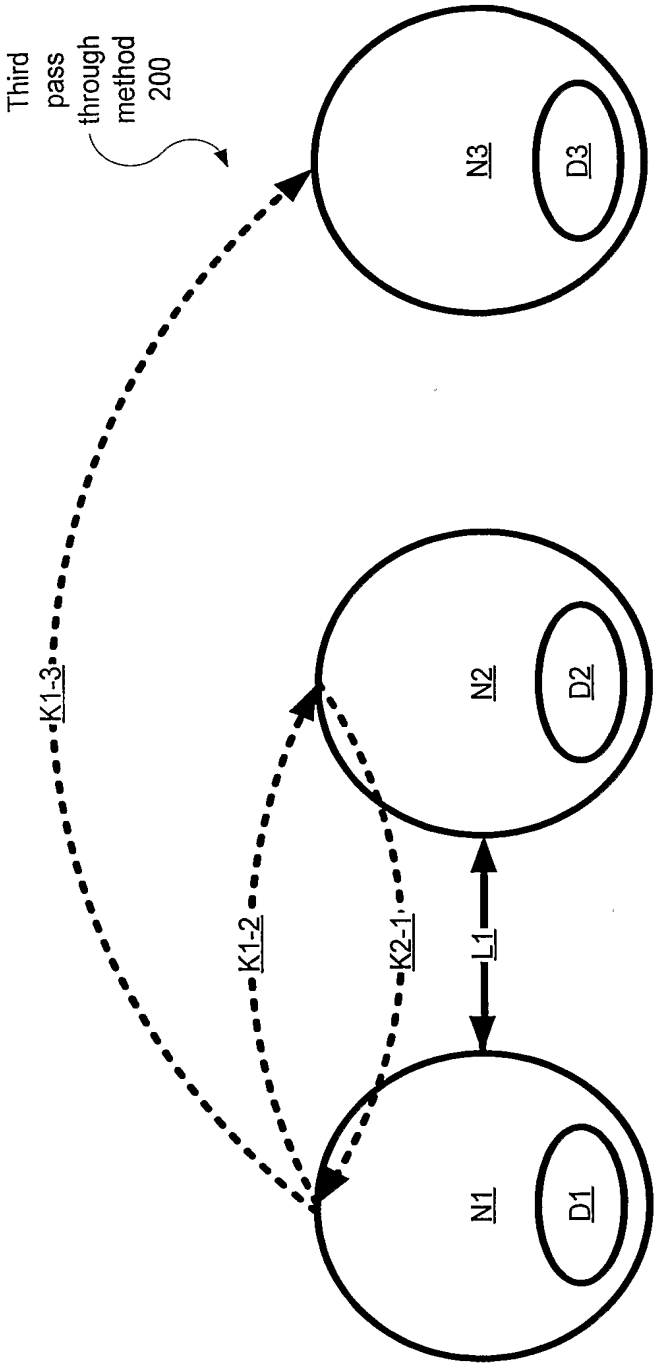



Table IV
Database D3

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |

Table XI
Database D2

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |
| 1 | N1 | N1 |

Table VIII
Database D1

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |
| 1 | N2 | N2 |
| 2 | N3 | N2 |

30

Fig. 8

Table IV
Database D3

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N3 | N/A |

Table XI
Database D2

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N2 | N/A |
| 1 | N1 | N1 |

Table V
Database D1

| Rank | Node name | Best Neighbour |
|---|---|---|
| Ø | N1 | N/A |
| 1 | N2 | N2 |

Fig. 9

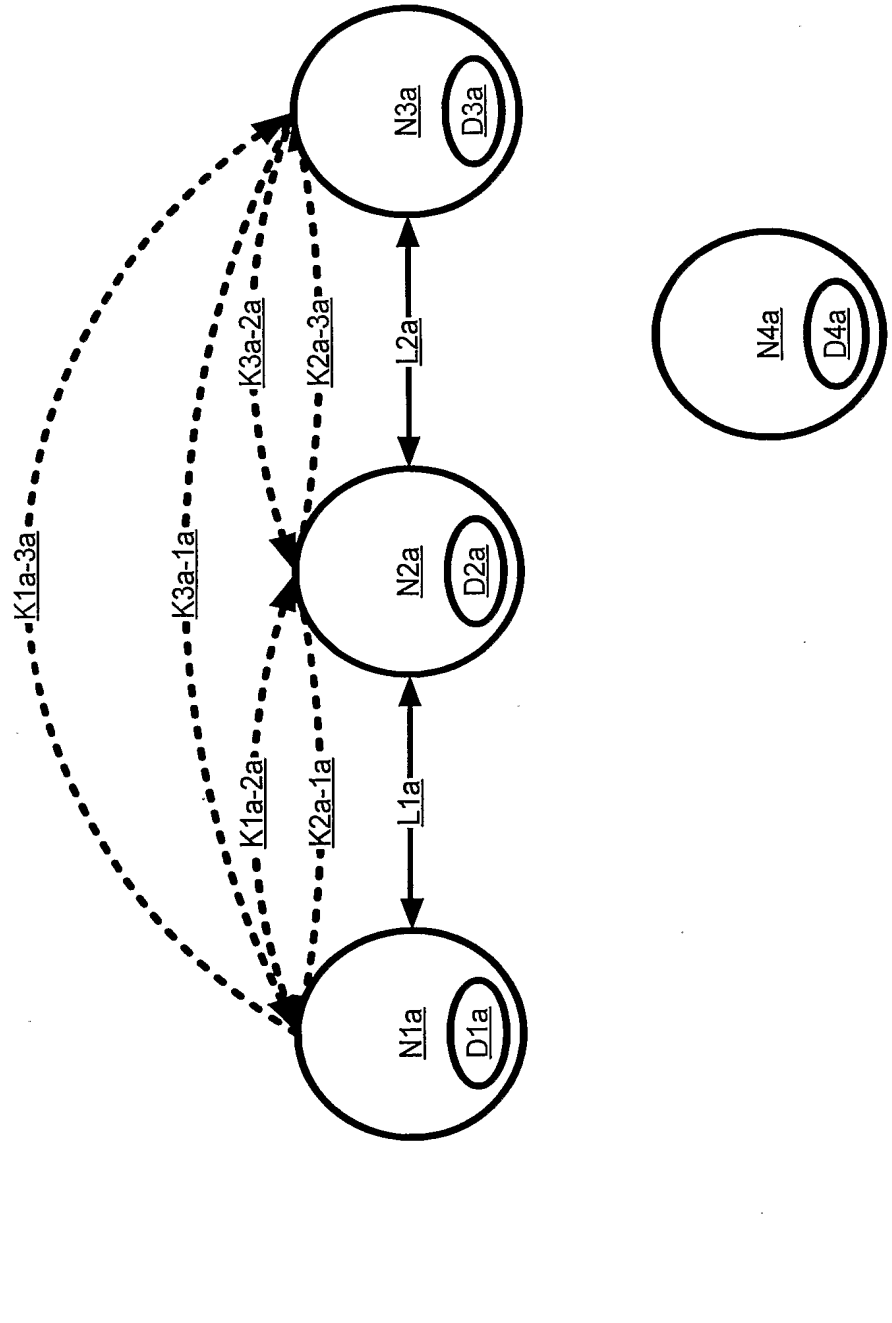

N3a
D3a
N4a
D4a
N2a
D2a
N1a
D1a
L2a
L1a
K1a-3a
K3a-1a
K1a-2a
K2a-1a
K3a-2a
K2a-3a
30a

Fig. 10

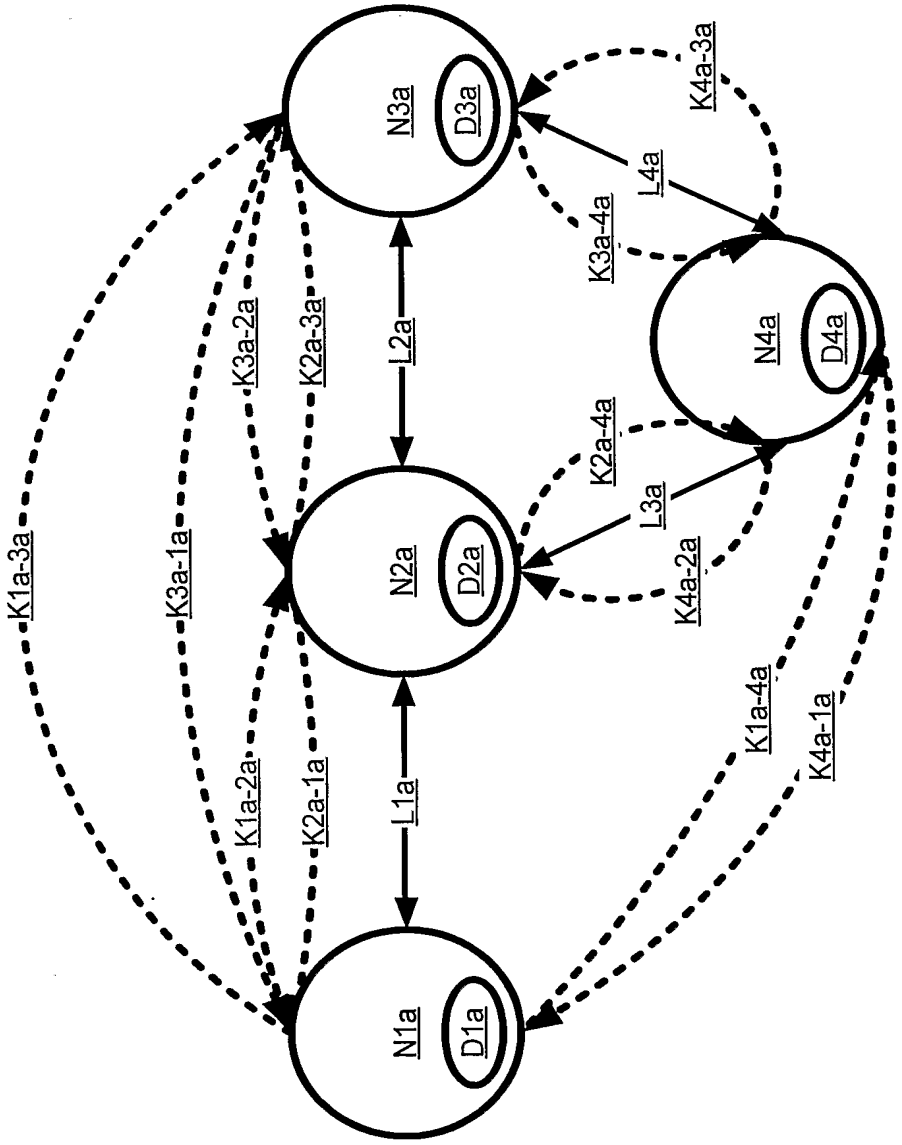
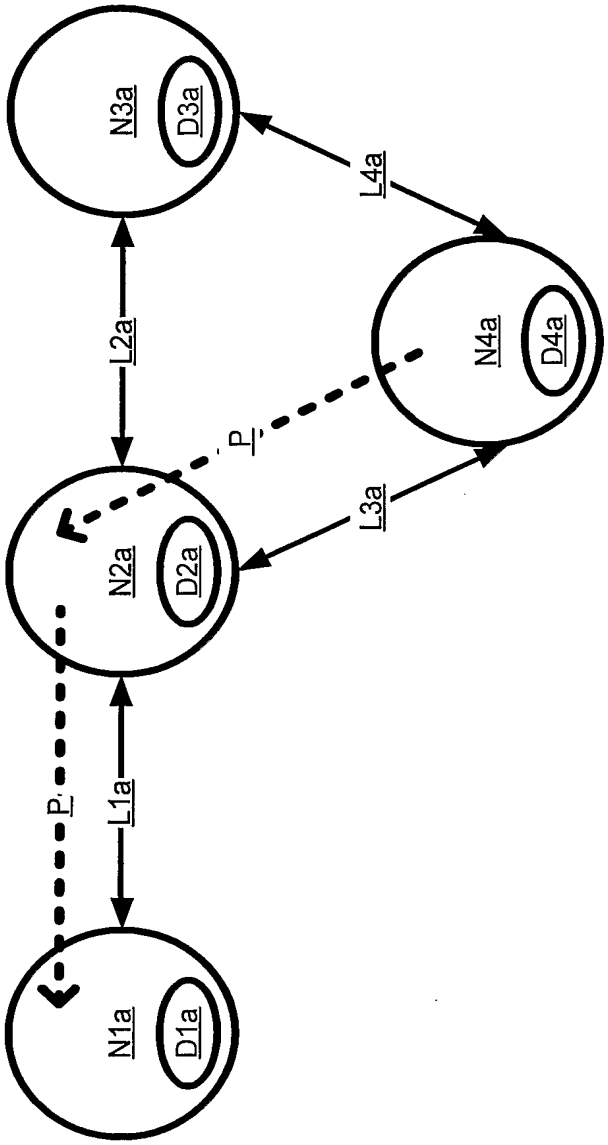

N3a
D3a
N2a
D2a
N4a
D4a
N1a
D1a
L1a
L2a
L3a
L4a
K1a-3a
K3a-1a
K1a-2a
K2a-1a
K3a-2a
K2a-3a
K3a-4a
K4a-3a
K2a-4a
K4a-2a
K1a-4a
K4a-1a
30a

Fig. 11

Fig. 12



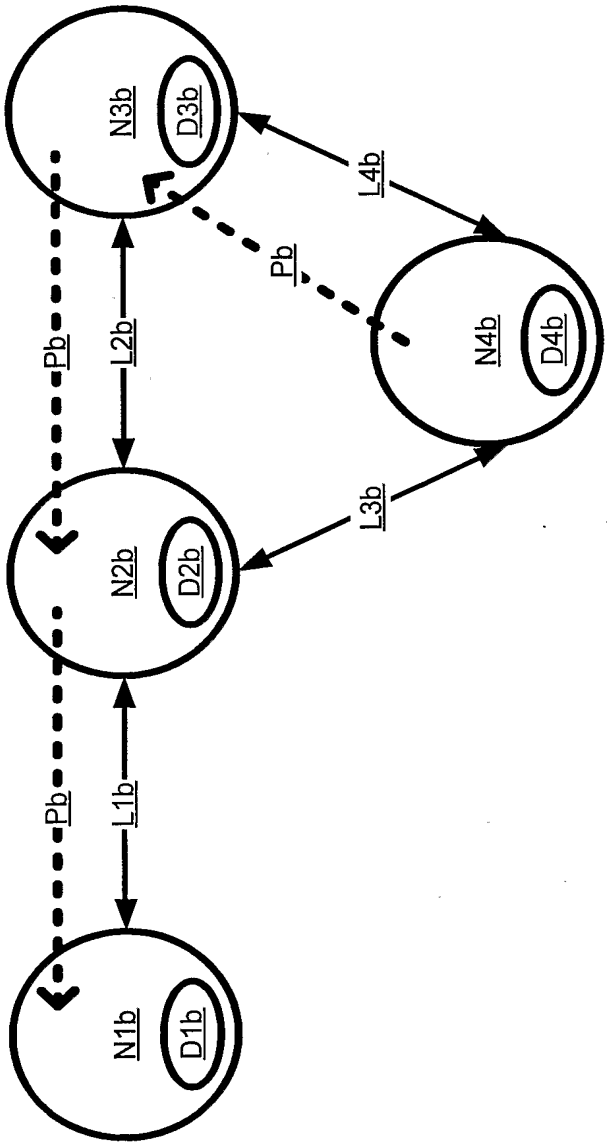



Fig. 13

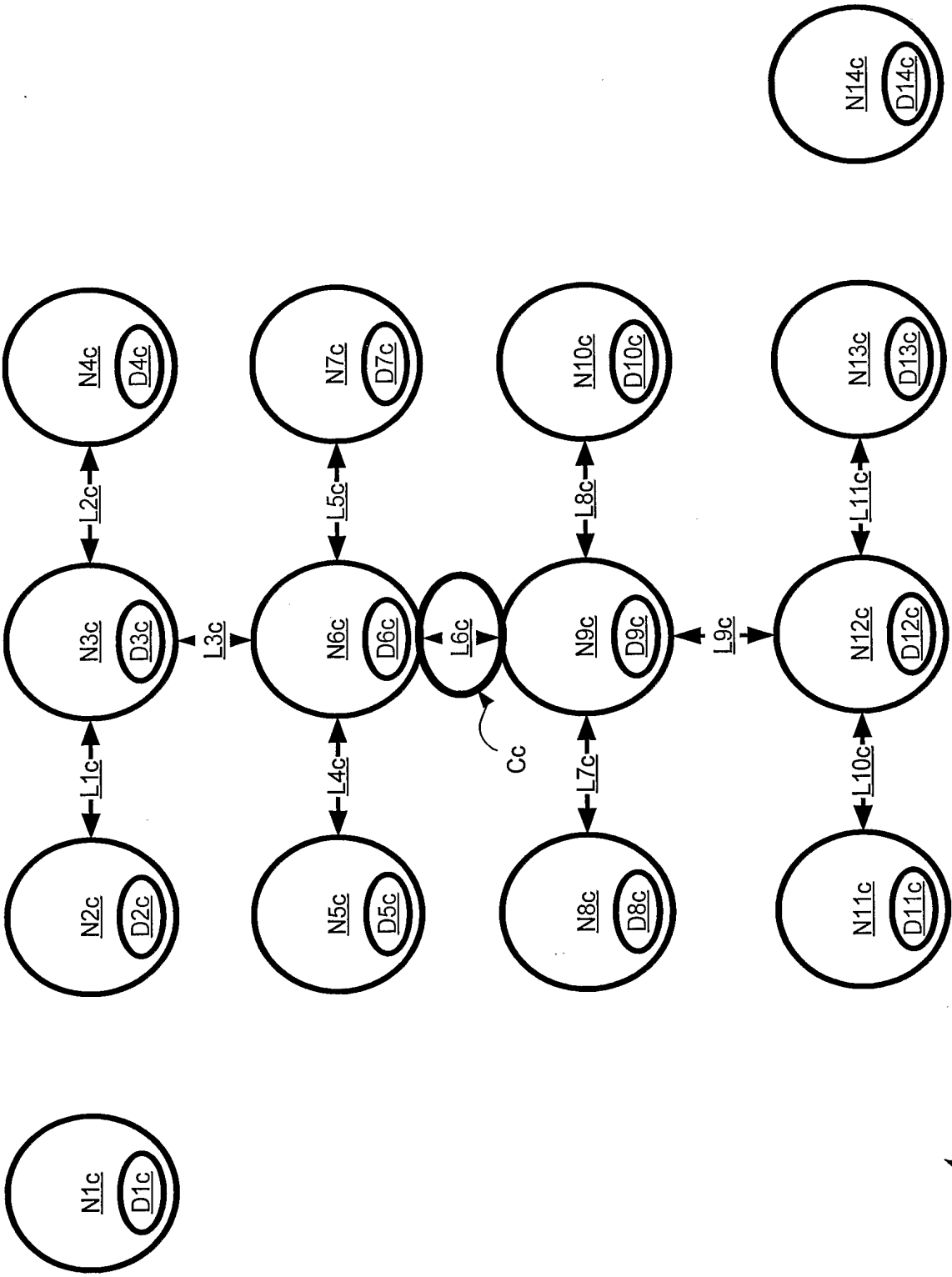

N1c
D1c
N2c
D2c
N3c
D3c
N4c
D4c
N5c
D5c
N6c
D6c
N7c
D7c
N8c
D8c
N9c
D9c
N10c
D10c
N11c
D11c
N12c
D12c
N13c
D13c
N14c
D14c
L1c
L2c
L3c
L4c
L5c
L6c
L7c
L8c
L9c
L10c
L11c
Cc
30c

Fig. 14

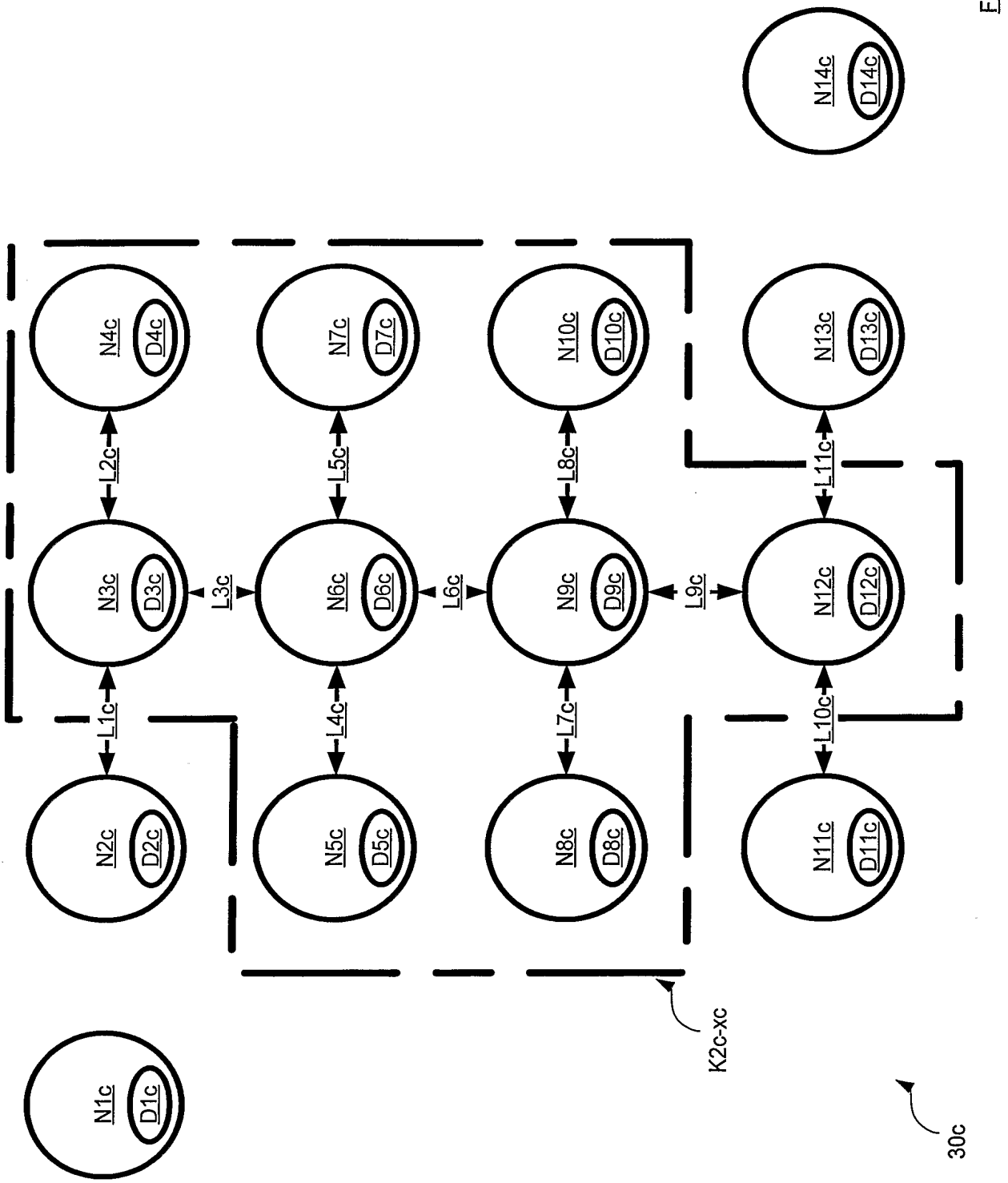

N1c
D1c
N2c
D2c
N3c
D3c
N4c
D4c
N5c
D5c
N6c
D6c
N7c
D7c
N8c
D8c
N9c
D9c
N10c
D10c
N11c
D11c
N12c
D12c
N13c
D13c
N14c
D14c
L1c
L2c
L3c
L4c
L5c
L6c
L7c
L8c
L9c
L10c
L11c
K2c-xc
30c

Fig. 15

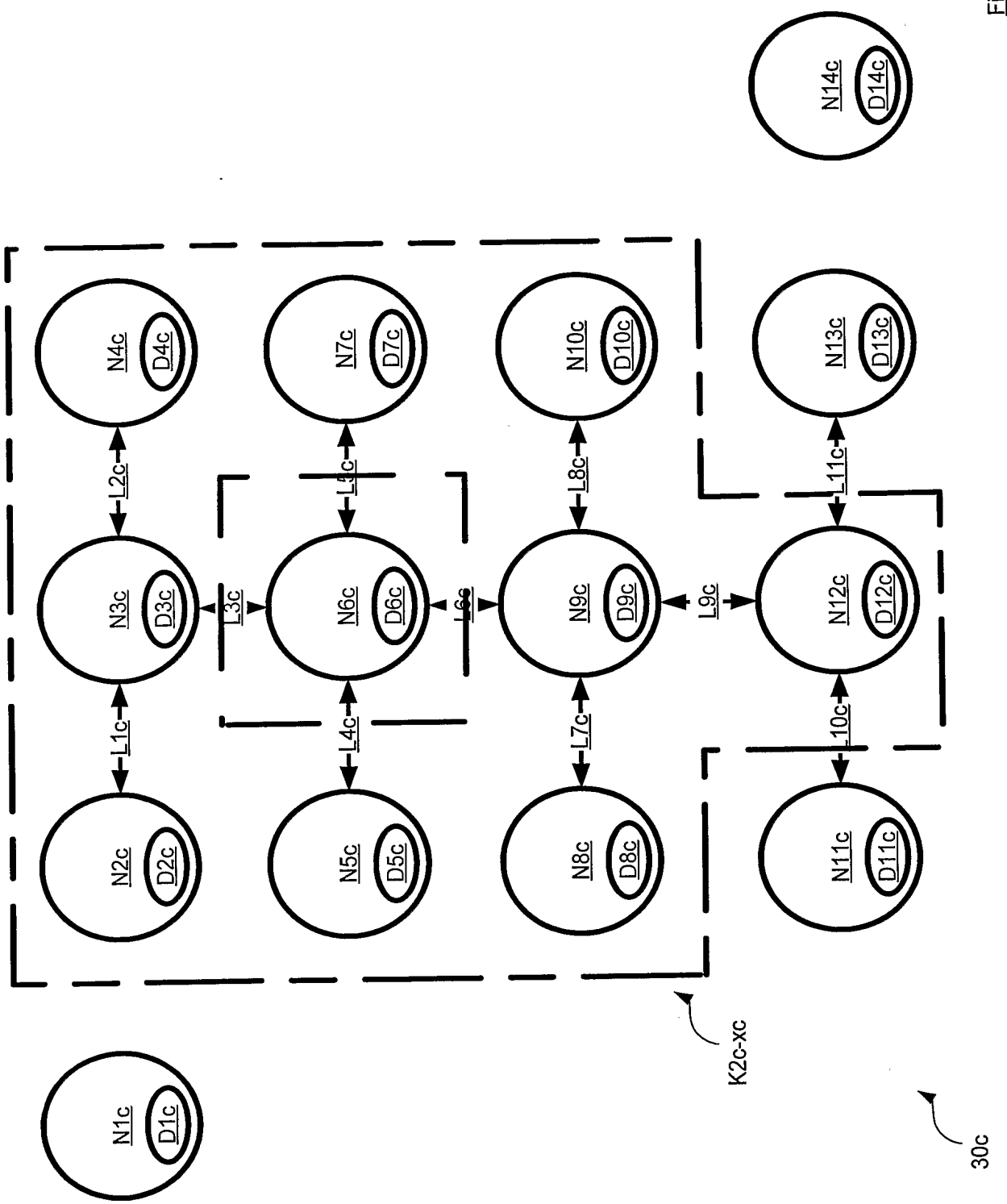

N1c
D1c
N2c
D2c
N3c
D3c
N4c
D4c
N5c
D5c
N6c
D6c
N7c
D7c
N8c
D8c
N9c
D9c
N10c
D10c
N11c
D11c
N12c
D12c
N13c
D13c
N14c
D14c
L1c
L2c
L3c
L4c
L6c
L7c
L8c
L9c
10c
L11c
K2c-xc
30c

Fig. 16

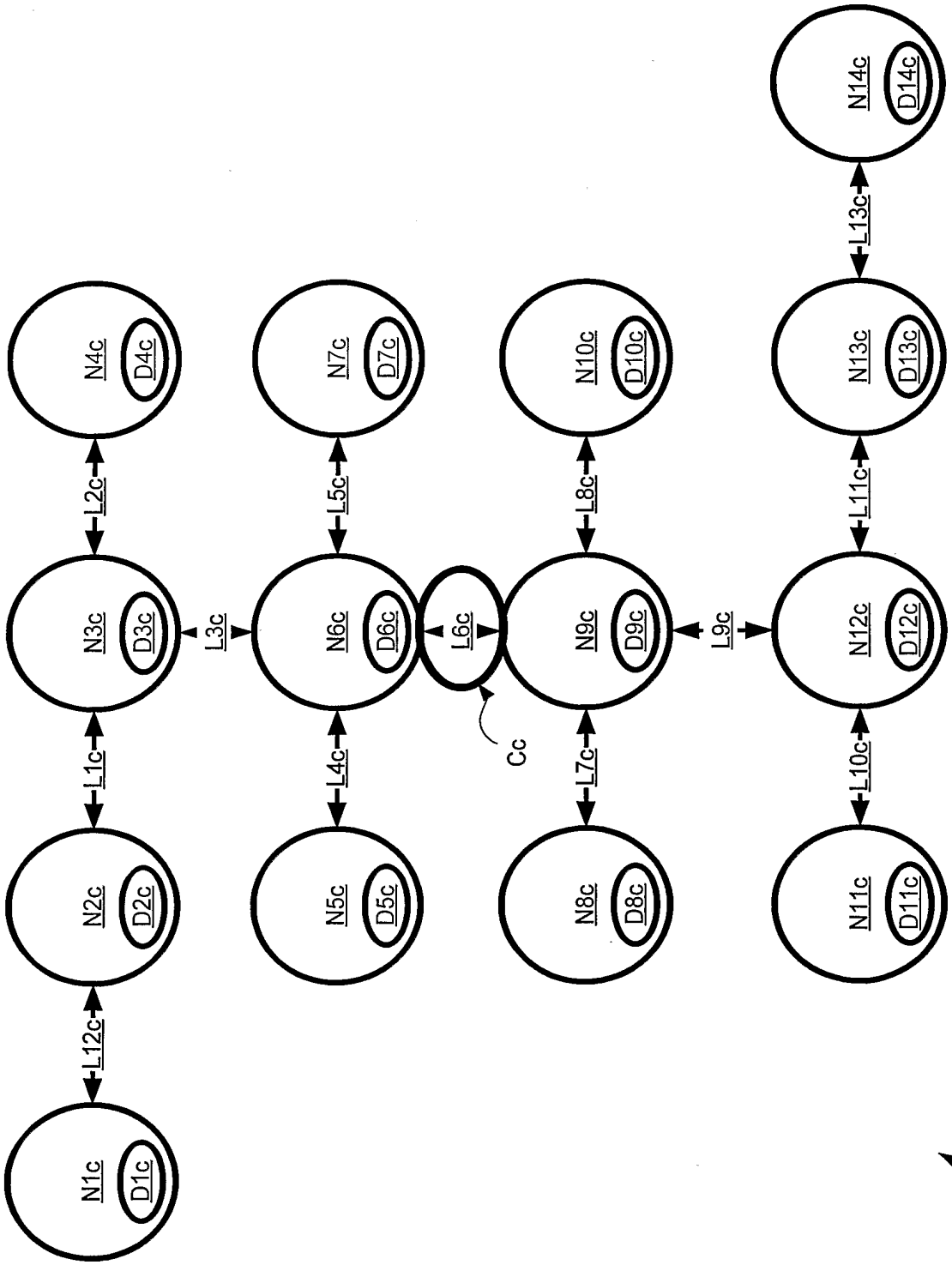

N1c
D1c
L12c
N2c
D2c
L1c
N3c
D3c
L2c
N4c
D4c
L3c
N5c
D5c
L4c
N6c
D6c
L5c
N7c
D7c
L6c
Cc
N8c
D8c
L7c
N9c
D9c
L8c
N10c
D10c
L9c
N11c
D11c
L10c
N12c
D12c
L11c
N13c
D13c
L13c
N14c
D14c
30c

Fig. 14

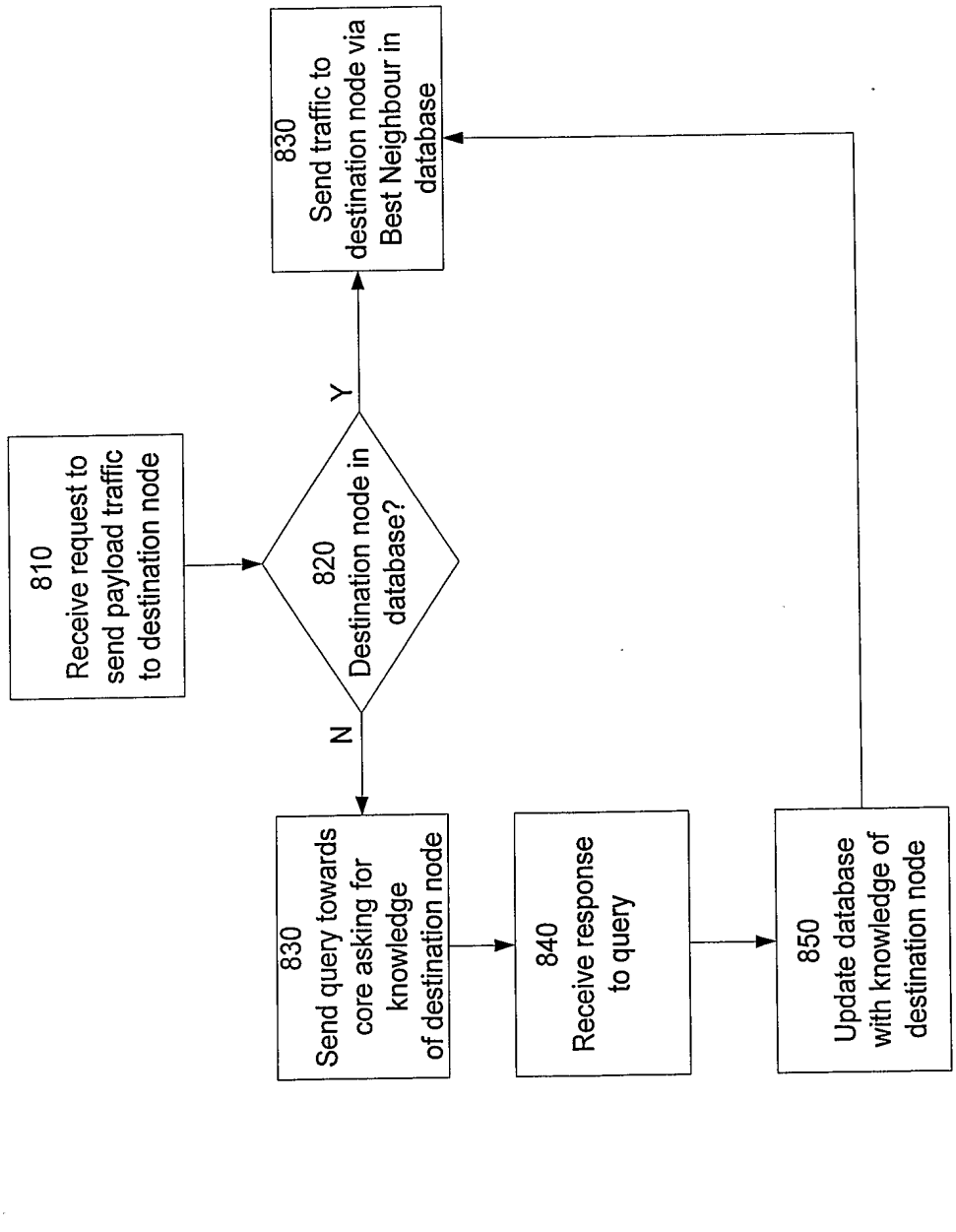

810
Receive request to send payload traffic to destination node
820
Destination node in database?
Y
N
830
Send traffic to destination node via Best Neighbour in database
830
Send query towards core asking for knowledge of destination node
840
Receive response to query
850
Update database with knowledge of destination node
800

Fig. 18

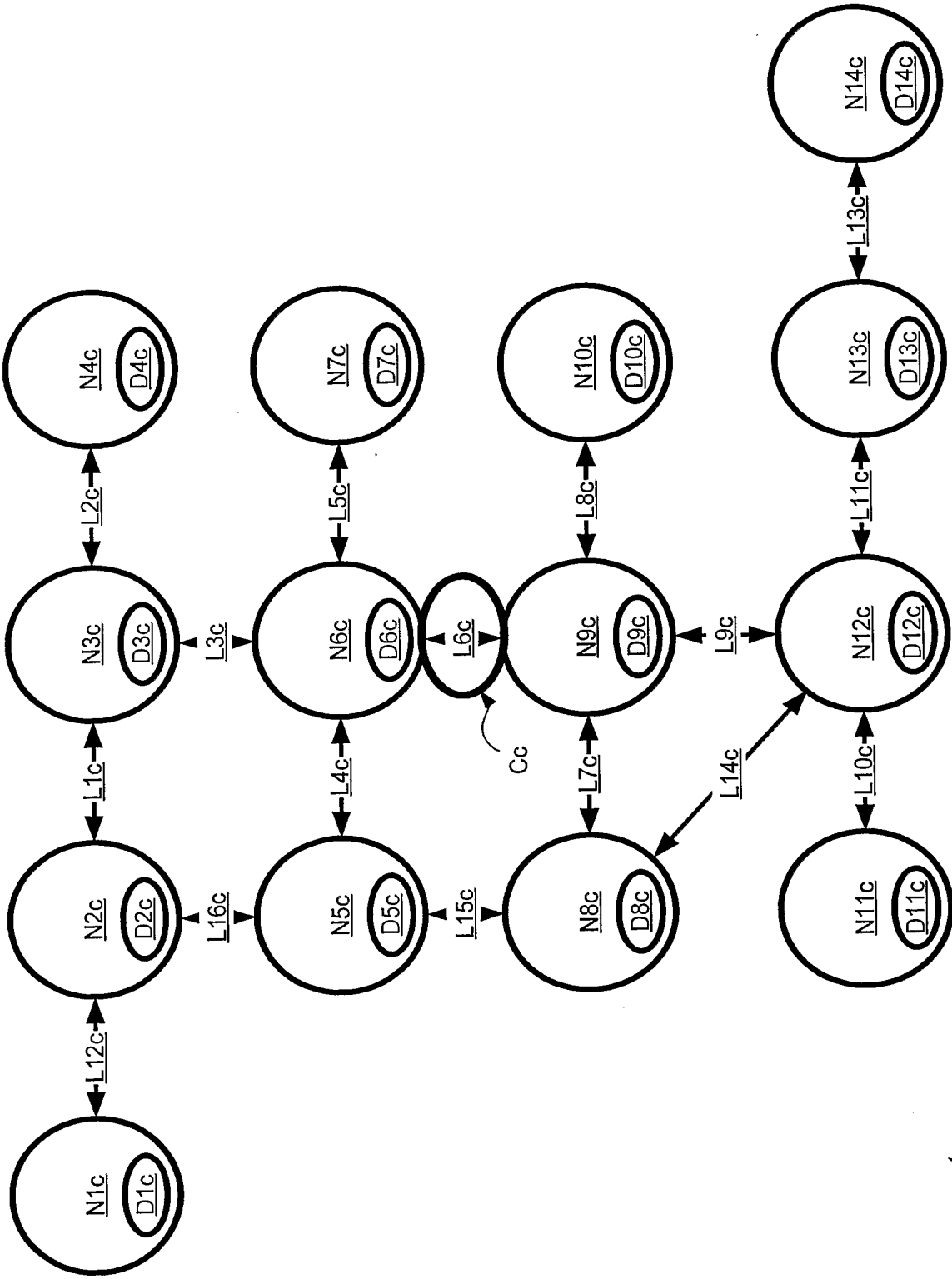

N1c
D1c
N2c
D2c
N3c
D3c
N4c
D4c
N5c
D5c
N6c
D6c
N7c
D7c
N8c
D8c
N9c
D9c
N10c
D10c
N11c
D11c
N12c
D12c
N13c
D13c
N14c
D14c
L1c
L2c
L3c
L4c
L5c
L6c
L7c
L8c
L9c
L10c
L11c
L12c
L13c
L14c
L15c
L16c
Cc
30c

Fig. 19

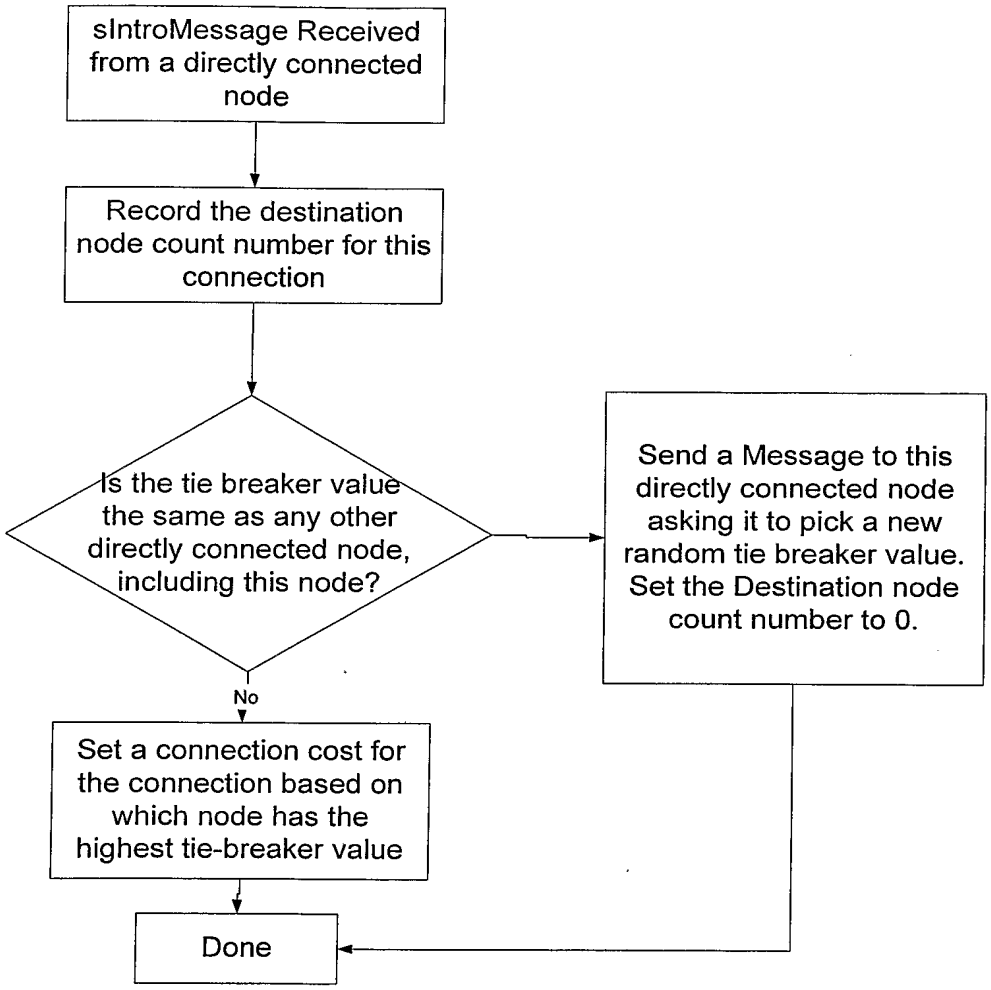

sIntroMessage Received from a directly connected node
Record the destination node count number for this connection
Is the tie breaker value the same as any other directly connected node, including this node?
Send a Message to this directly connected node asking it to pick a new random tie breaker value. Set the Destination node count number to 0.
No
Set a connection cost for the connection based on which node has the highest tie-breaker value
Done

Fig 20

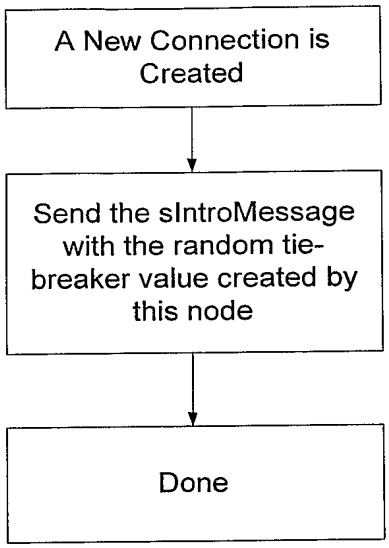

A New Connection is Created
Send the sIntroMessage with the random tie-breaker value created by this node
Done

Fig 21

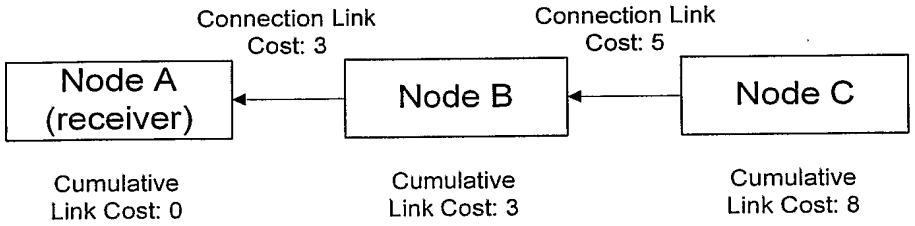
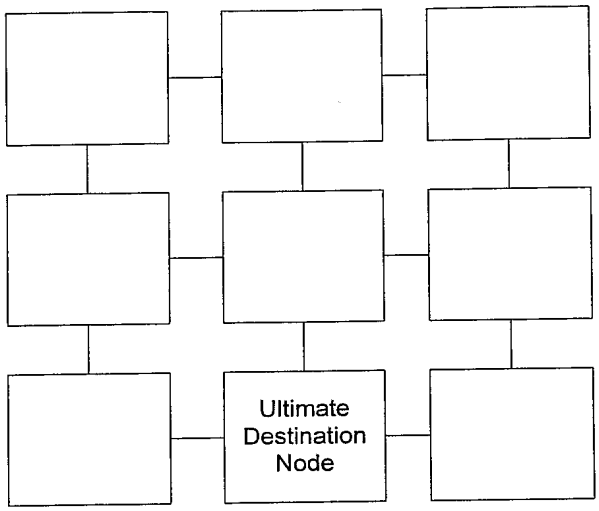
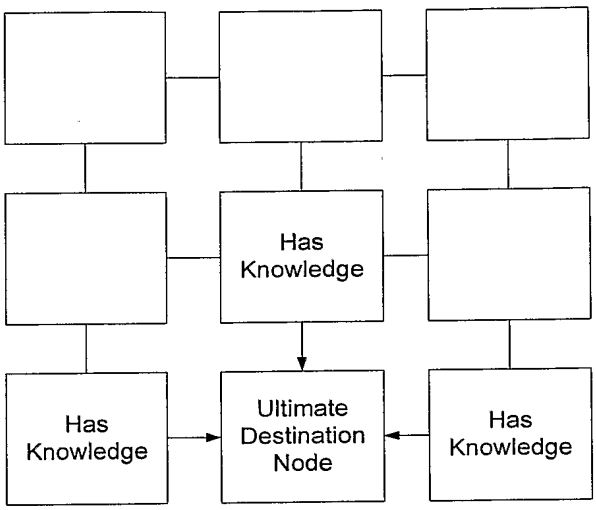

Connection Link Cost: 3
Connection Link Cost: 5
Node A (receiver)
Node B
Node C
Cumulative Link Cost: 0
Cumulative Link Cost: 3
Cumulative Link Cost: 8

Fig 22



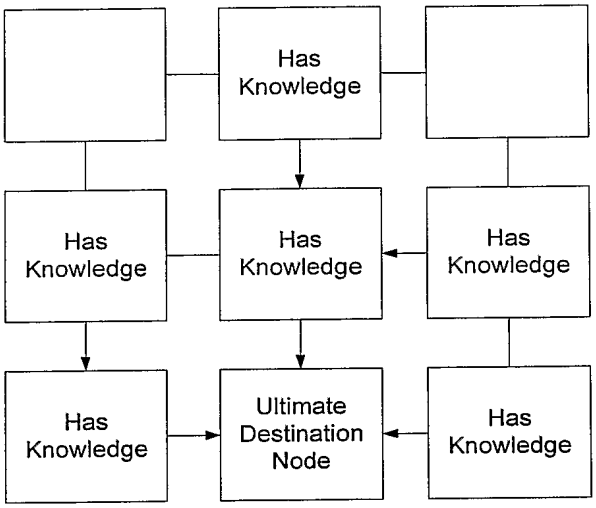

The ultimate destination node is connected to several nodes in the network and prepares to send an initial destination node update to its directly connected neighbor nodes.

Fig 23



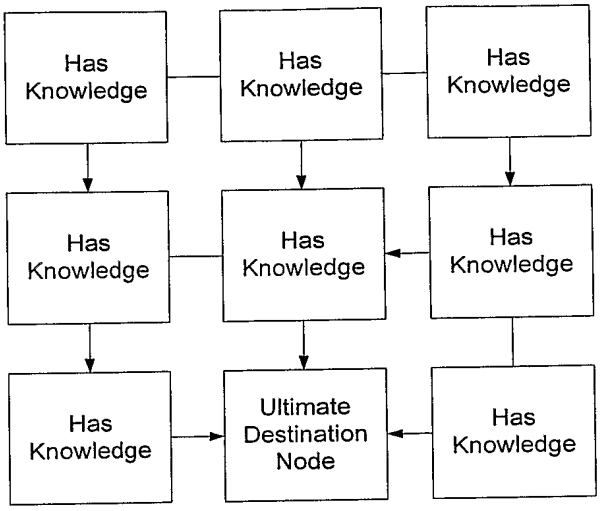

As destination node knowledge spreads, each node that gets told of the destination node selects the node that told it as the 'target node' for messages routed to that destination node.

Fig 24




Knowledge of the destination node continues to spread, with each node that is told about the destination node choosing the node that told it. If another node provided it with a better hop cost later, the node would choose the directly connected node with the better hop cost.

Fig 25




In this step all nodes in the network are aware of the destination node and have a 'target node' that they can send messages that are destined for the destination node.

Fig 26

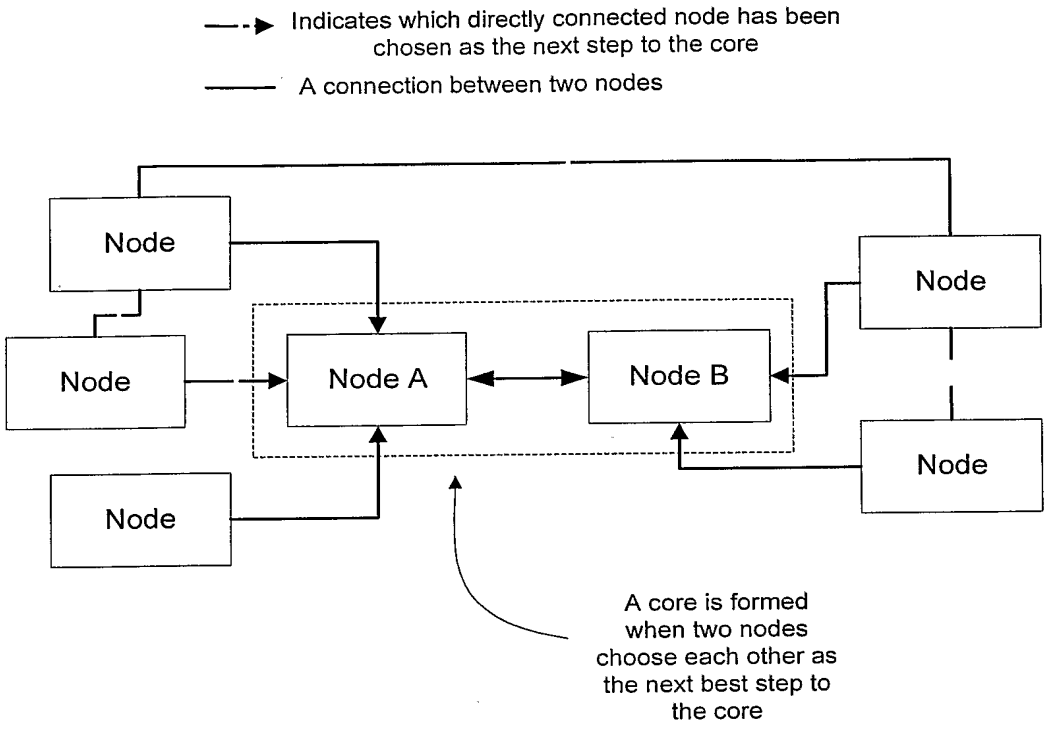

Indicates which directly connected node has been chosen as the next step to the core
A connection between two nodes
Node
Node
Node A
Node B
Node
Node
Node
A core is formed when two nodes choose each other as the next best step to the core

Fig 27

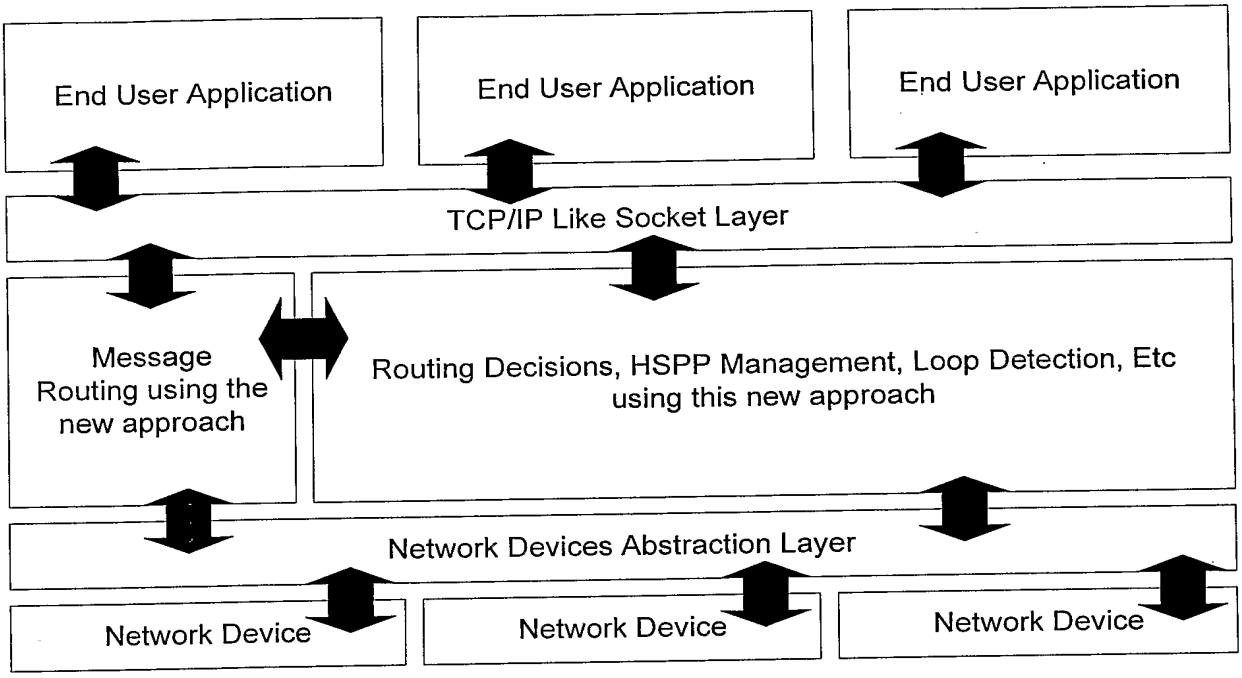

End User Application
End User Application
End User Application
TCP/IP Like Socket Layer
Message Routing using the new approach
Routing Decisions, HSPP Management, Loop Detection, Etc using this new approach
Network Devices Abstraction Layer
Network Device
Network Device
Network Device

Fig 28

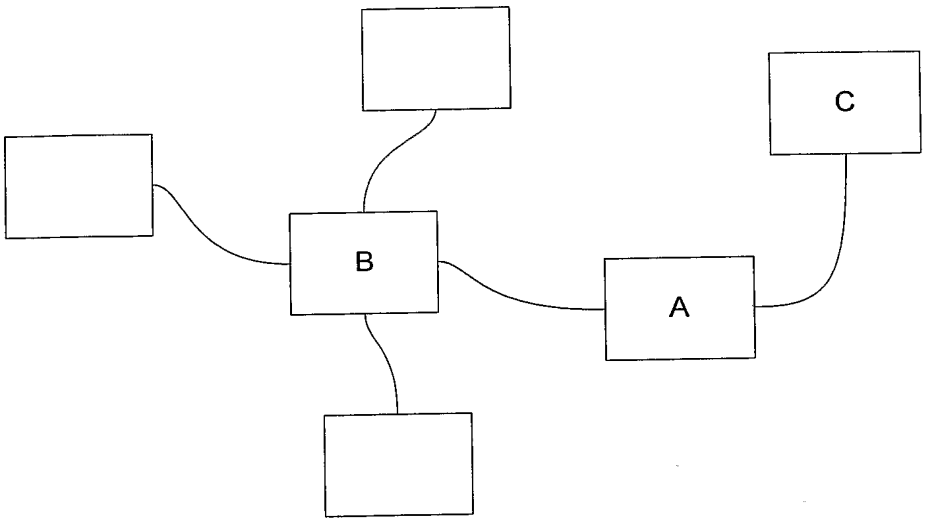



Fig 29

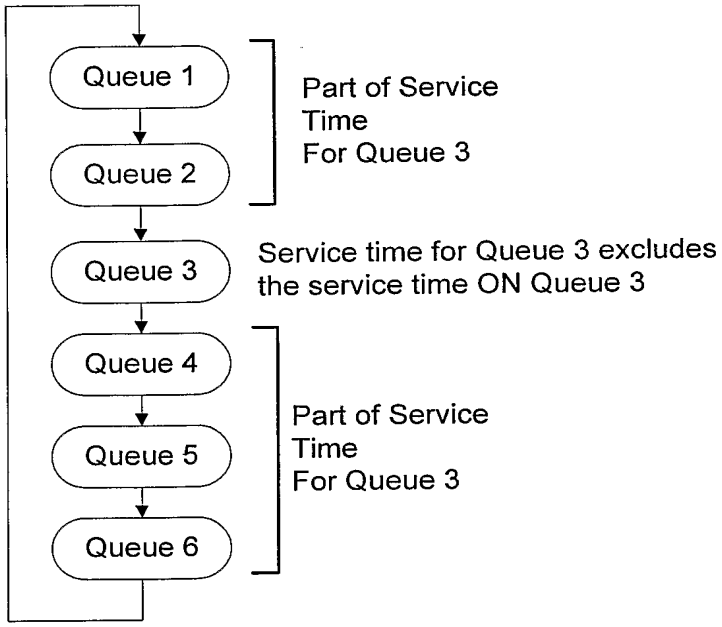
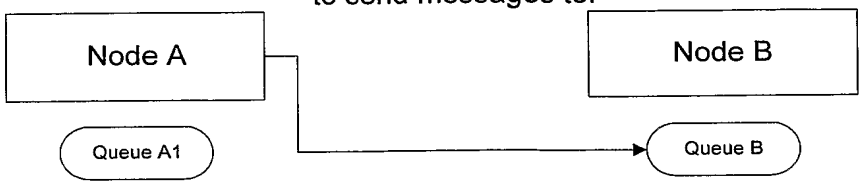
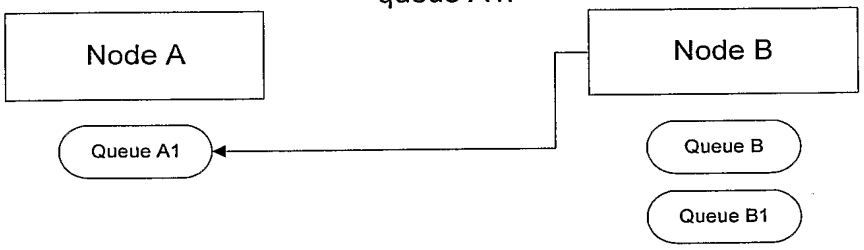

Queue 1
Queue 2
Queue 3
Queue 4
Queue 5
Queue 6
Part of Service Time For Queue 3
Service time for Queue 3 excludes the service time ON Queue 3
Part of Service Time For Queue 3

Fig 30

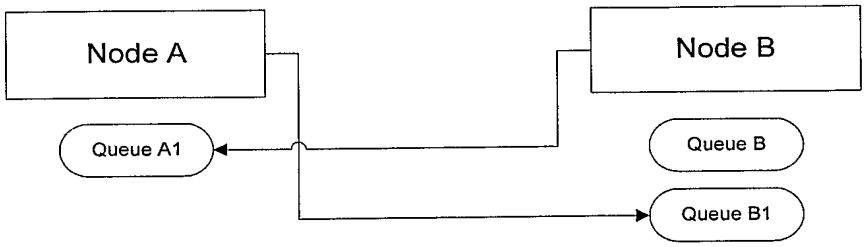
Step 1 – Node A creates queue A1 and asks node B For a queue to send messages to.




Step 2 – Node B creates queue B1 and tells node A about it using queue A1.




Step 3 – Node A sends a messages to queue B1 and node B sends ACK's to node A1.




Step 4 – Node A sends a messages to queue B confirming a connection to queue B1

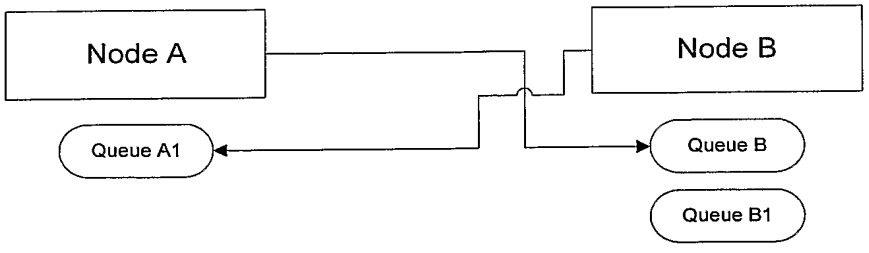
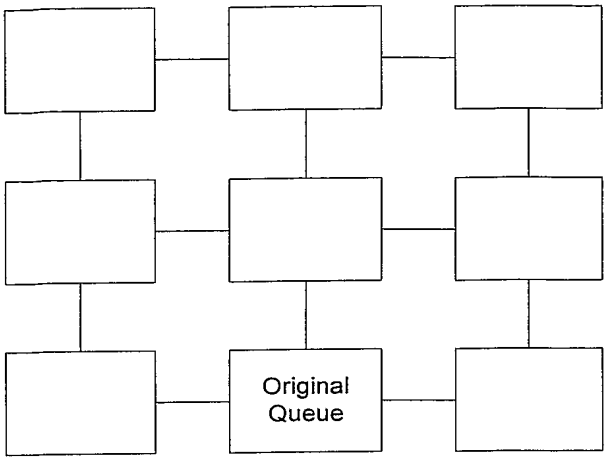
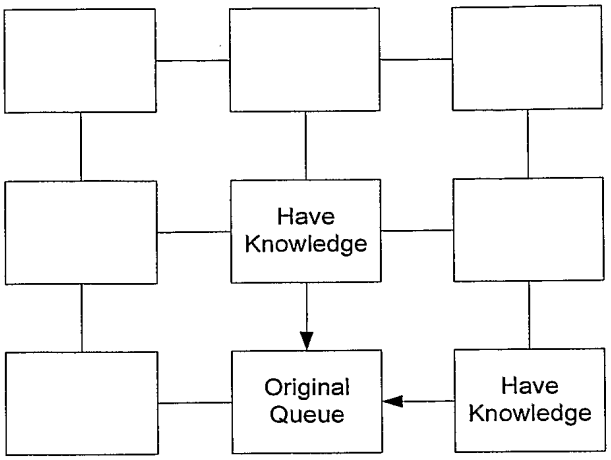


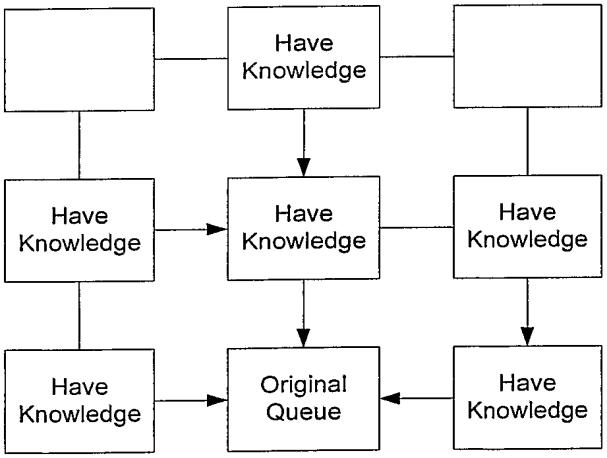

Fig 31



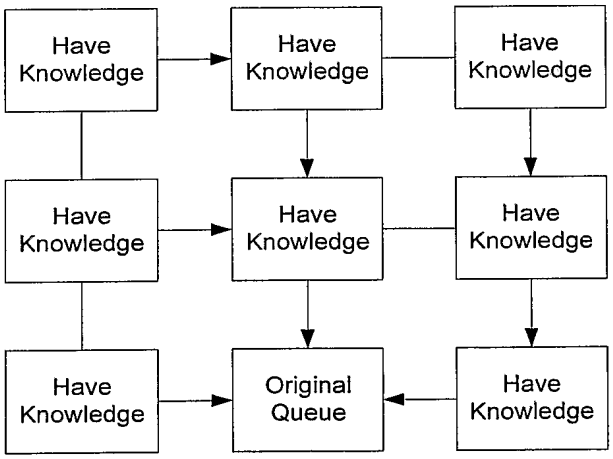

Step 1 – an EUS has created a Queue, and only the node that contains the EUS knows of the queue.




Step 2 – Next iteration, two directly connected nodes now know of the queue. The arrows represent chosen destinations.




Step 3 – Knowledge continues to spread




Step 4 – The whole network now has knowledge of the queue and there are no loops.

Fig 32

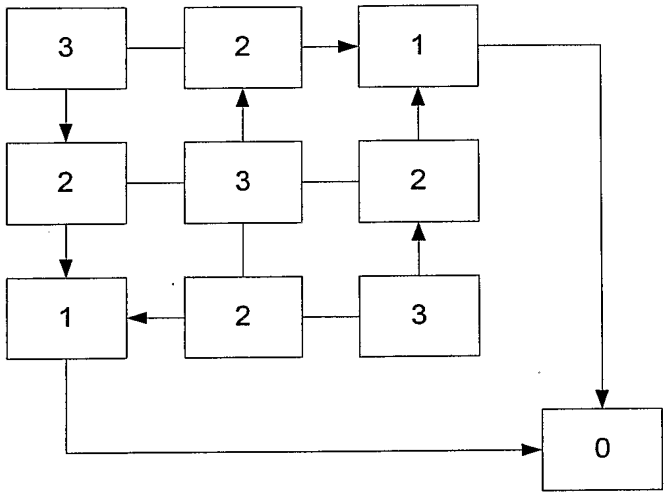



Fig 33

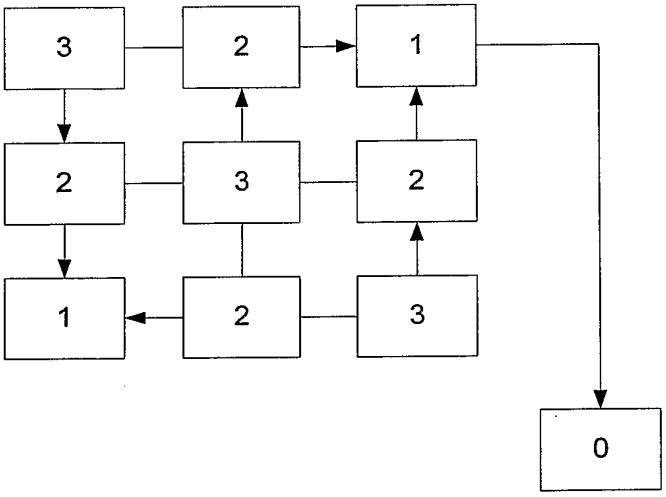



Fig 34

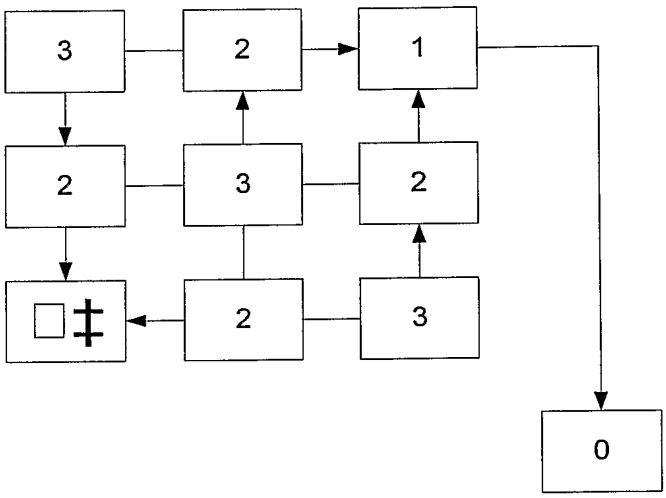



Fig 35

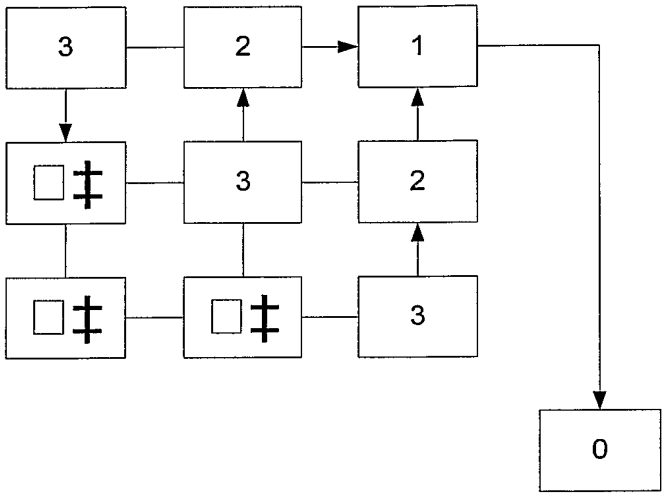



Fig 36

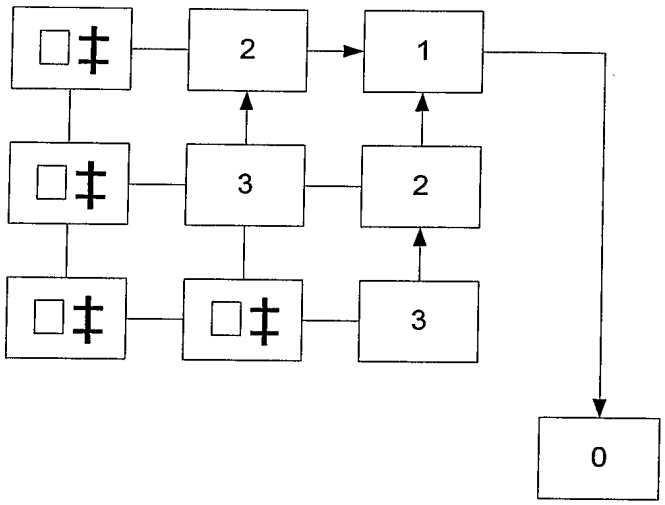



Fig 37

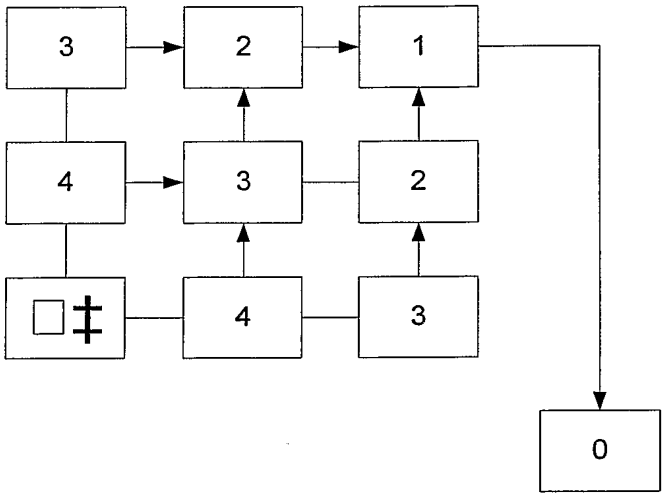



Fig 38

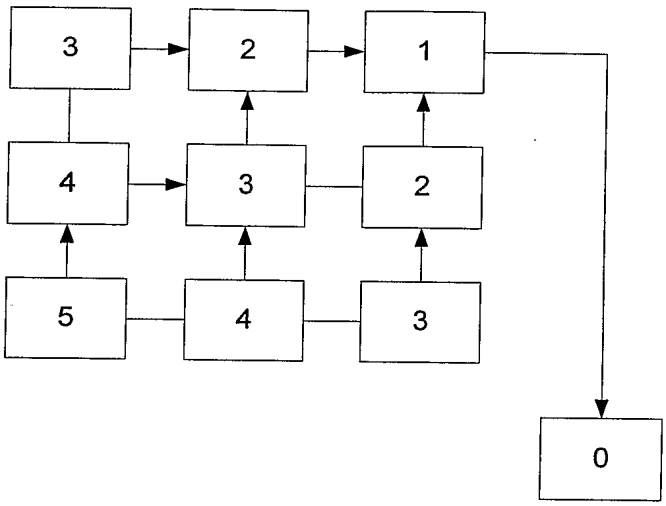



Fig 39

Incoming Latency Update

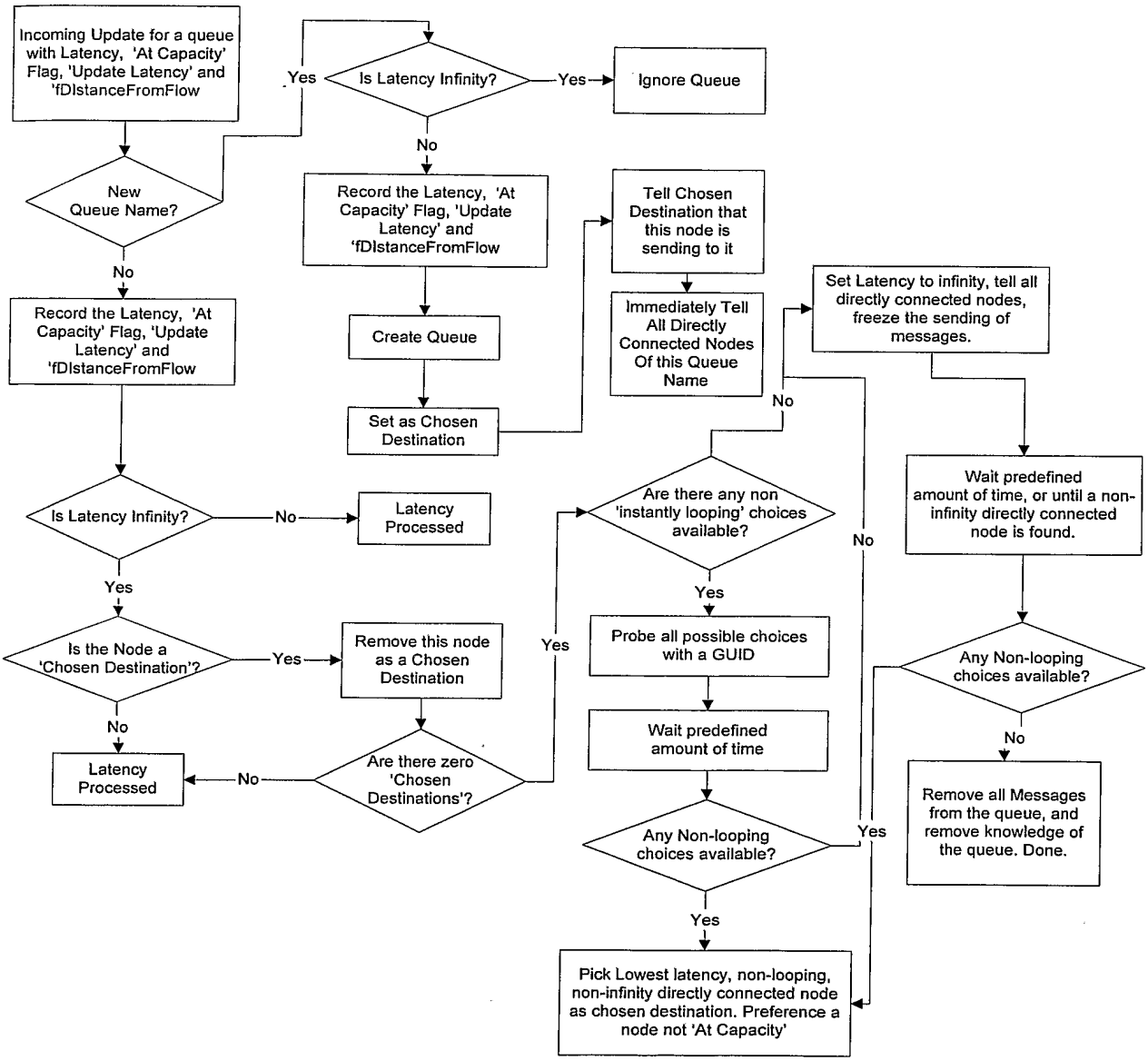



Fig 40

Latency At Infinity

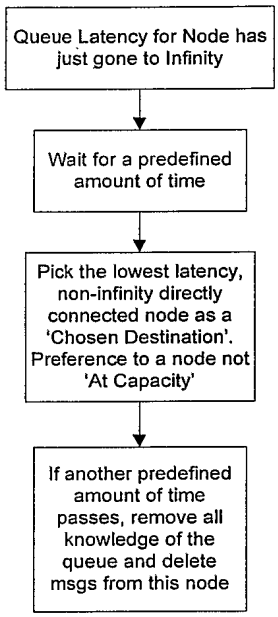
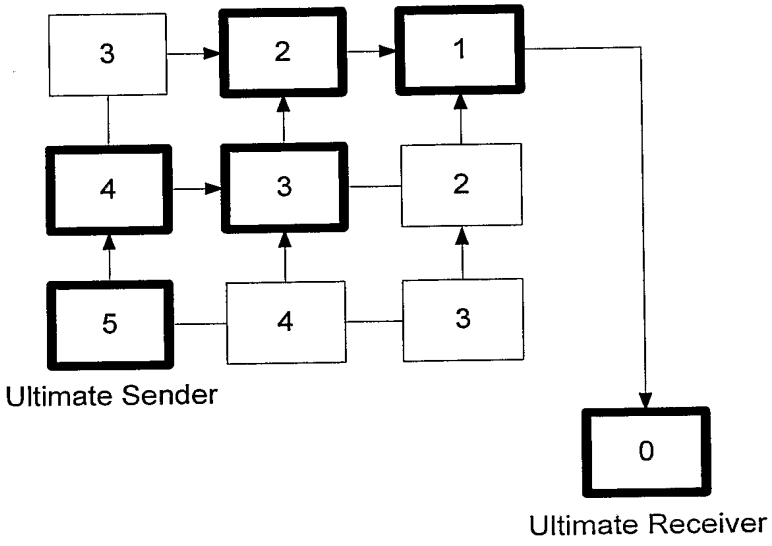



Fig 41




The nodes with the thick outlines constitute the data path

Fig 42

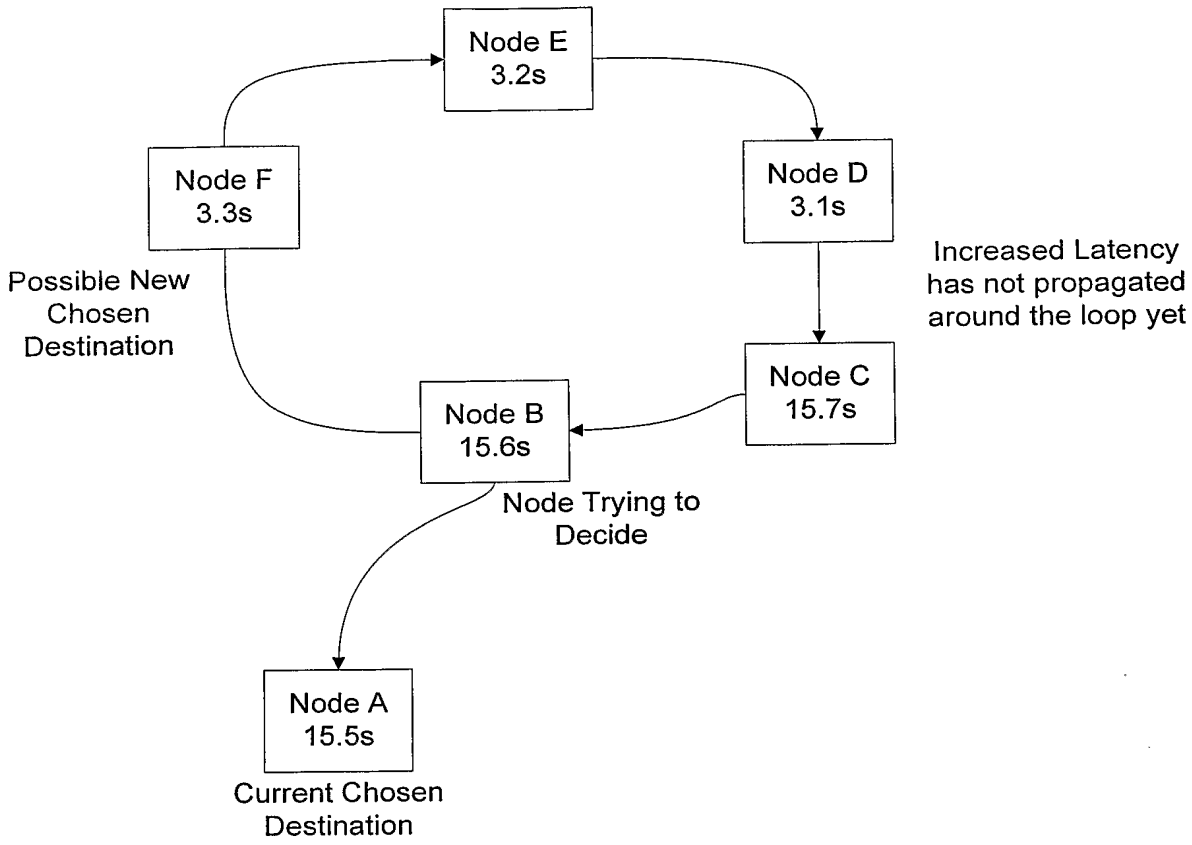

Node E
3.2s
Node F
3.3s
Node D
3.1s
Possible New
Chosen
Destination
Increased Latency
has not propagated
around the loop yet
Node C
15.7s
Node B
15.6s
Node Trying to
Decide
Node A
15.5s
Current Chosen
Destination

Fig 43

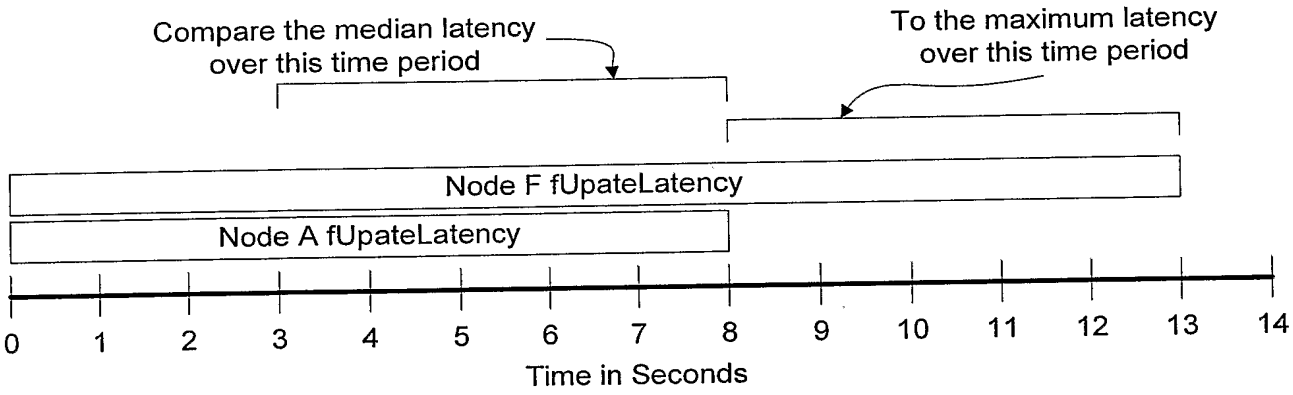

Compare the median latency
over this time period
To the maximum latency
over this time period
Node F fUpateLatency
Node A fUpateLatency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time in Seconds

Fig 44

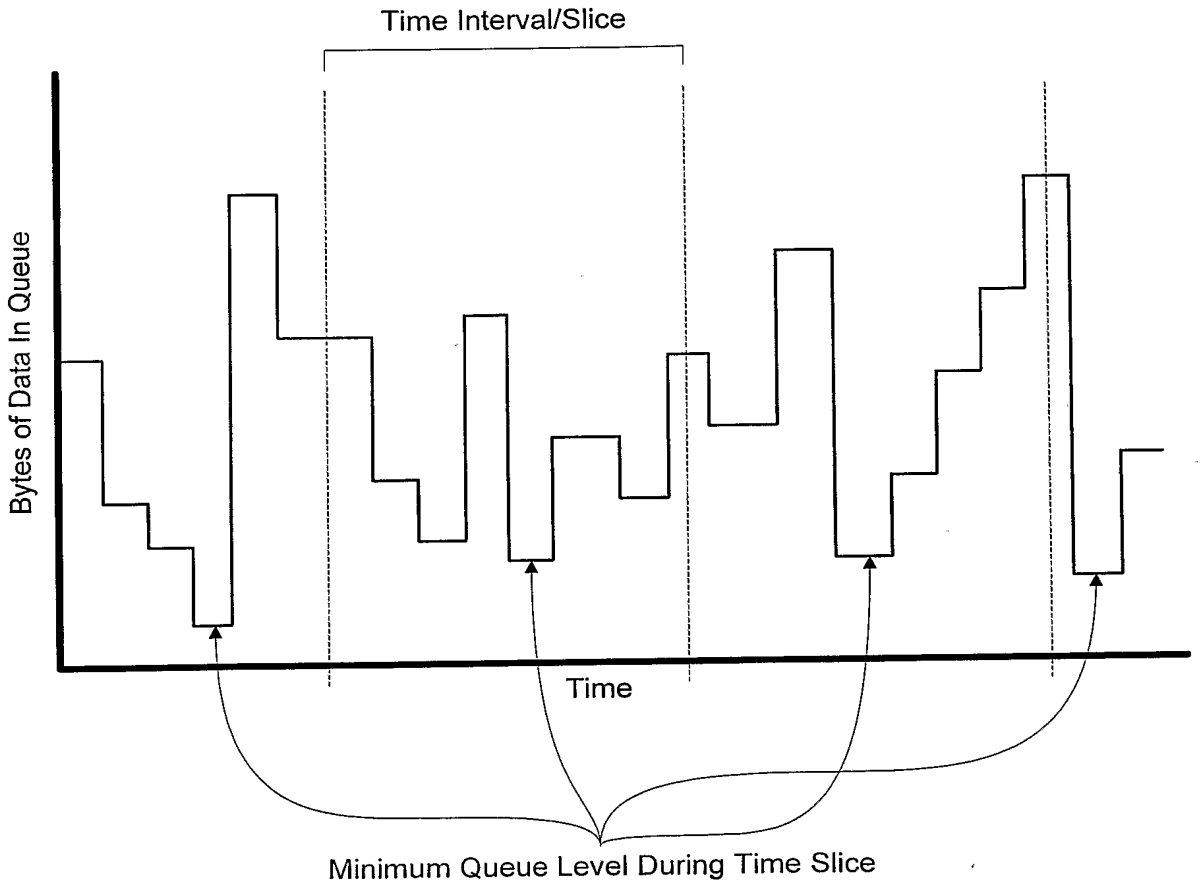

Time Interval/Slice
Bytes of Data In Queue
Time
Minimum Queue Level During Time Slice

Fig 45

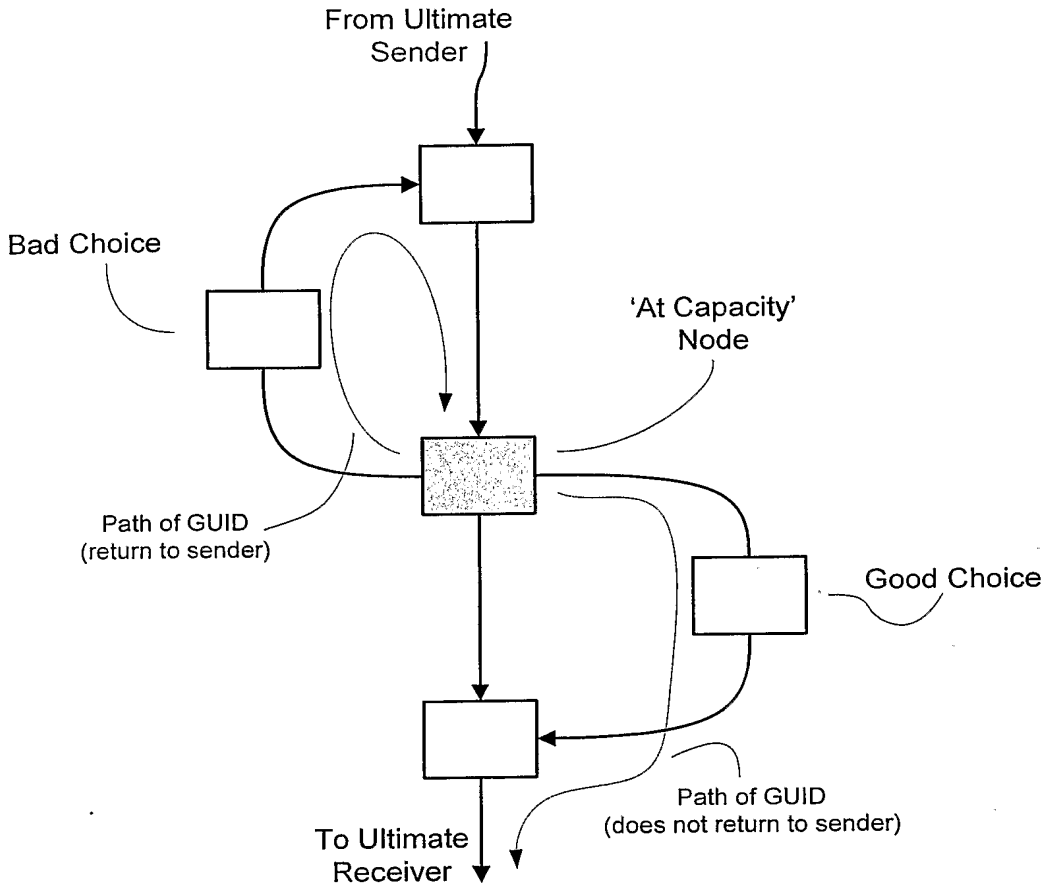

From Ultimate Sender
Bad Choice
'At Capacity' Node
Path of GUID (return to sender)
Good Choice
Path of GUID (does not return to sender)
To Ultimate Receiver

Fig 46

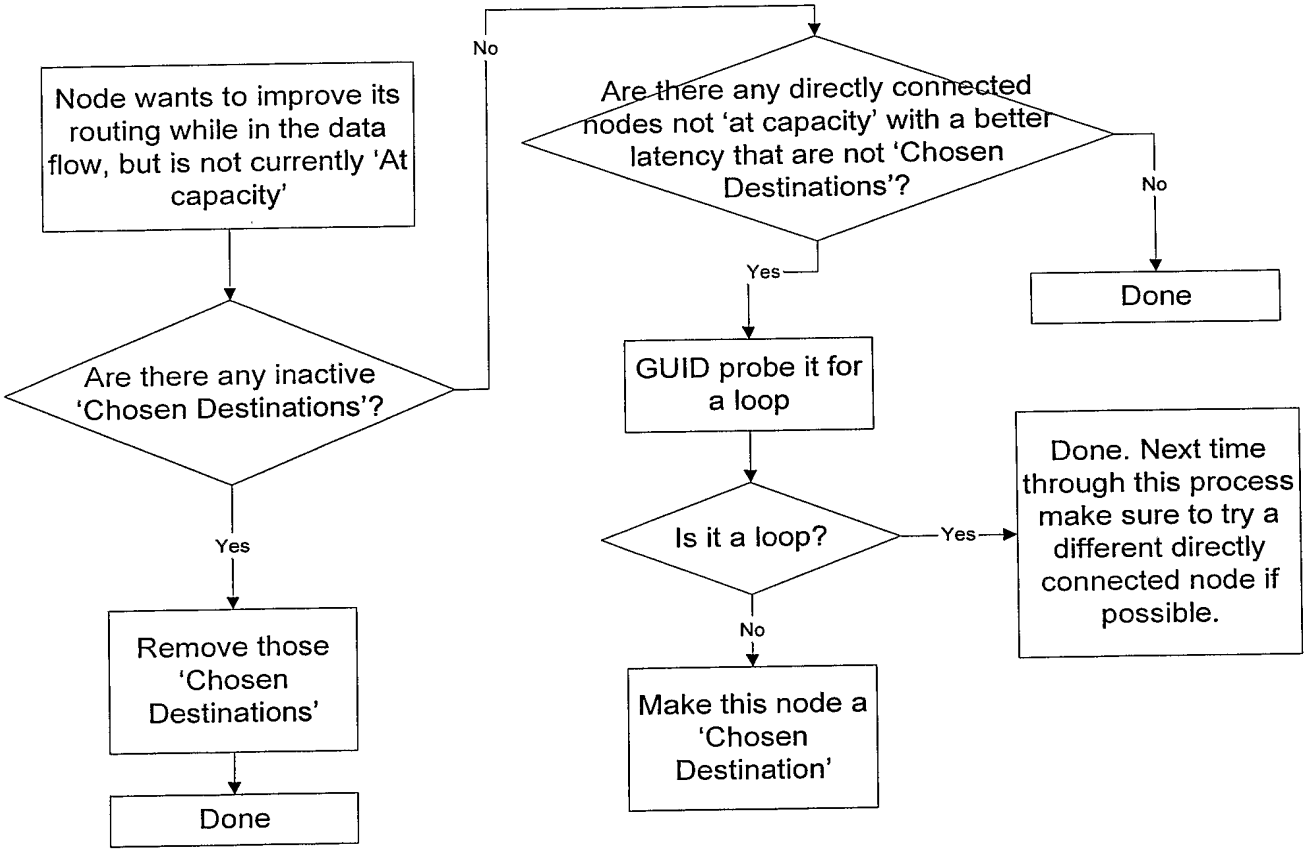

Node wants to improve its routing while in the data flow, but is not currently 'At capacity'
Are there any inactive 'Chosen Destinations'?
No
Yes
Remove those 'Chosen Destinations'
Done
Are there any directly connected nodes not 'at capacity' with a better latency that are not 'Chosen Destinations'?
No
Done
Yes
GUID probe it for a loop
Is it a loop?
Yes
Done. Next time through this process make sure to try a different directly connected node if possible.
No
Make this node a 'Chosen Destination'

Fig 47

The latencies of these nodes are spiraling upwards because of the loop. fUpdateLatency will also be spiraling up.

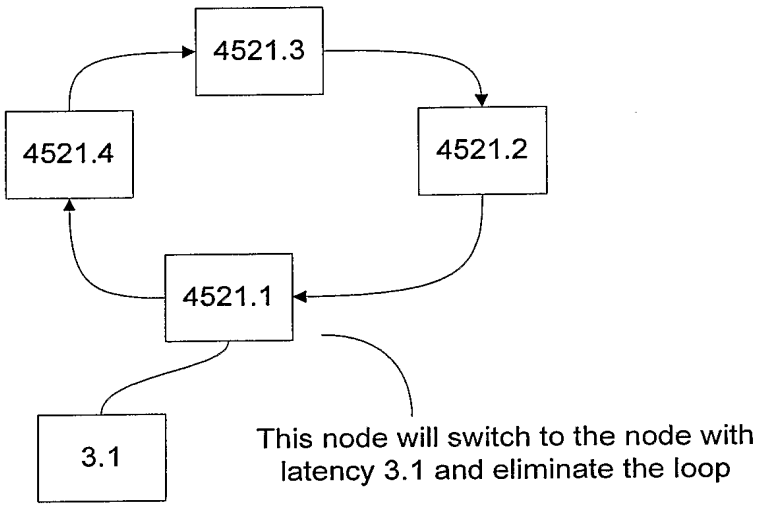



Fig 48

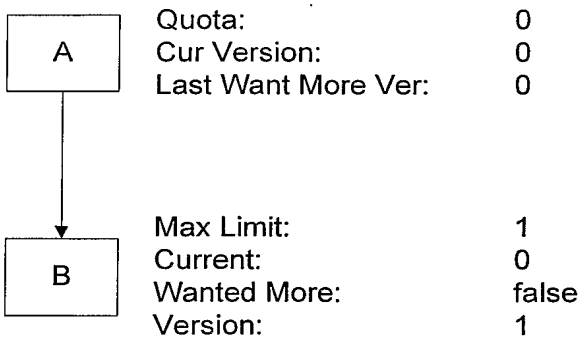

A
Quota: 0
Cur Version: 0
Last Want More Ver: 0
B
Max Limit: 1
Current: 0
Wanted More: false
Version: 1

Fig 49

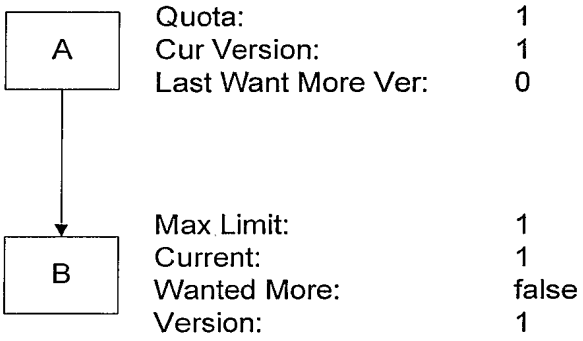

A
Quota: 1
Cur Version: 1
Last Want More Ver: 0
B
Max Limit: 1
Current: 1
Wanted More: false
Version: 1

Fig 50

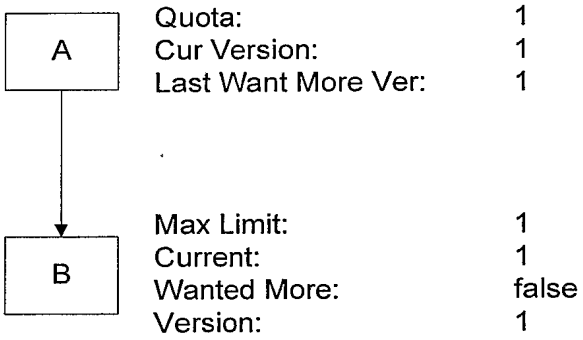

A
Quota: 1
Cur Version: 1
Last Want More Ver: 1
B
Max Limit: 1
Current: 1
Wanted More: false
Version: 1

Fig 51

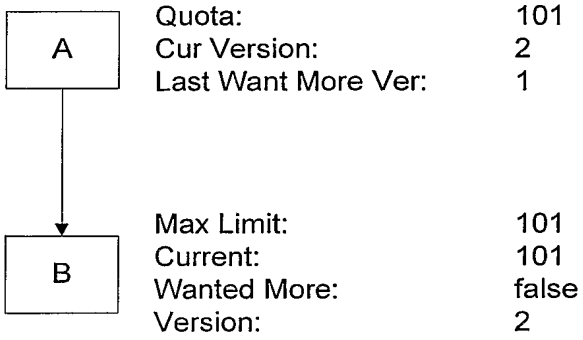

A
Quota: 101
Cur Version: 2
Last Want More Ver: 1
B
Max Limit: 101
Current: 101
Wanted More: false
Version: 2

Fig 52

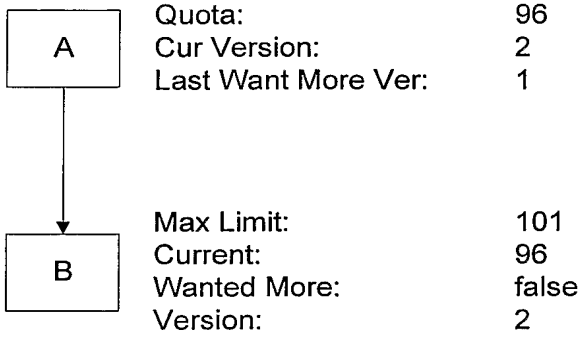
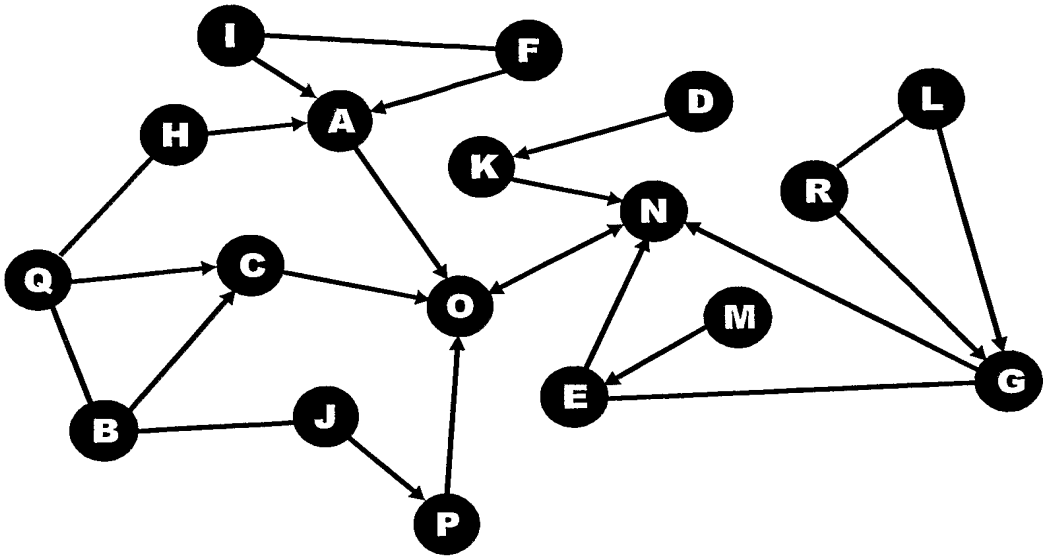

A
Quota: 96
Cur Version: 2
Last Want More Ver: 1
B
Max Limit: 101
Current: 96
Wanted More: false
Version: 2

Fig 53

A network of nodes connected by links. An arrow indicates a nodes choice for its next best step to the core. A line with two arrows indicates two nodes have chosen each other as their next best step to the core.




This is the identical network that has been rearranged to better show the hierarchy that is formed by having each node pick its next best step to the core. The two nodes at the top of the hierarchy form the core.

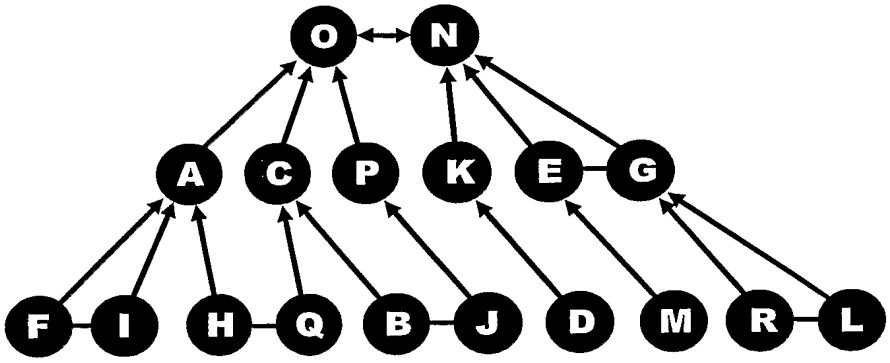



Fig 54